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A MONUMENT TO A FAMOUS ENGINEER.

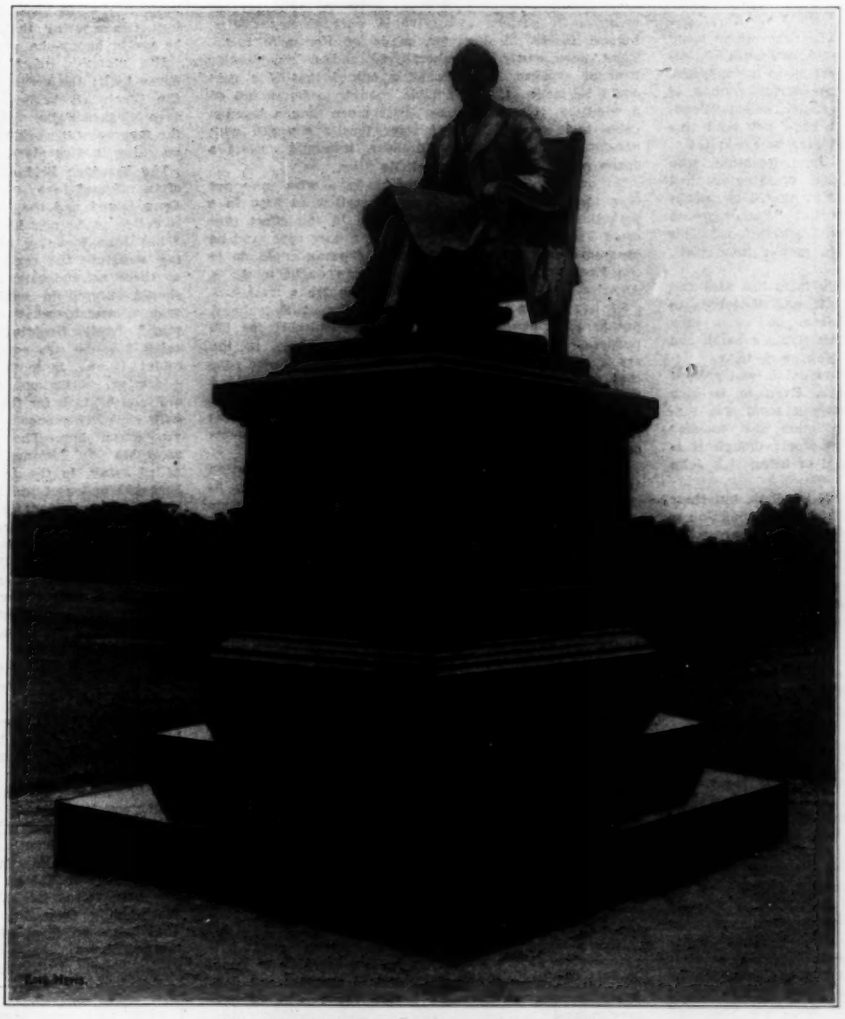
We illustrate herewith the monument to the late John A. Roebling, erected at Trenton, N. J., by the Roebling Memorial Association and unveiled with appropriate ceremonies on June 30. The cost of the statue was defrayed by contributions of the citizens of Trenton; and the afternoon of the ceremony was observed as a general holiday in that city. Over 15,000 persons assembled in Cadwalader Park, in which the statue is placed. Preceding the unveiling there was a parade of the 6,000 men employed in the Roebling Works.

A notable feature of the exercises was an oration delivered by Henry D. Estabrook, General Counsel of the Western Union Telegraph Co., which gave so interesting an account of Roebling's life and character that we print a large part of it below:

Those who know him best affirm that the statue of John Augustus Roebling, which you, the citizens of Trenton, have here and now erected to his memory, is a true and faithful likeness. But it is more. Through some Promethean fire that flames once in a life-time in the heart of genius, the sculptor has "in this rough work shaped out a man."

I am expected by those having these ceremonies in charge to translate into words what the sculptor has so admirably expressed in bronze, namely, the type and quality, the idiosyncrasy of your famous townsman. But words are all too plastic for such a task. As if his nature had been subdued to what it worked in, the ironmaster of Trenton was a man of iron. Iron was in his blood and sometimes entered his very soul—a man of iron, with the virtues of iron and the peccancies of iron to his account.

John A. Roebling's biography, written by the eldest son, is yet in manuscript and may never be published; but it is one of the most remarkable books I ever read. It is remarkable for its genuine literature which is Arcadian and original; remarkable for its naive philosophy, a trifle bilious, may be, but honest and unlacquered; remarkable for its analysis of men and events and for an acidulous humor that is almost styptic; but chiefly is it remarkable for the frank revealment of the intima vitae, the qualities and inequalities of the extraordinary man who was his father.



THE ROEBLING STATUE AT TRENTON, N. J.
(Unveiled June 30, 1908; Wm. Couper, Sculptor.)

John Augustus Roebling was born June, 1806, in Mulhausen, Germany, and the State of Thuringen. Mulhausen is an old walled town, founded in the year 800. The wall was really built to keep people out, though why anybody should want to get into Mulhausen is a matter of wonderment, after reading a description of it. Mulhausen—in the words of Tennyson—is

> "A sleepy town, where under the same wheel
> The same old rut is deepened year by year."

As for Thuringen, it is one of the poorest of the German States. The land is high and stony and cold. It was only by hard work and frugality to the utmost of self-denial that the people were able to eke out an existence. In those days there were no factories in Mulhausen, the mechanics and artisans doing their work in their own little houses, the whole family assisting, the women working quite as hard as the men. For more than a thousand years there had been hard work in Mulhausen, but no enterprise whatever, and work without enterprise is a kind of catalepsy. Life was stereotyped, society stratified.

To a man like Polycarp Roebling, father of John Roebling, the prescriptive life of this old German village was by no means irksome. He kept a tobacco shop and managed to smoke as much tobacco as he sold. Smoking in Germany, you know, is a solace, whereas in America it is an employment. To the German, smoke is a nimbus and begets revery and an introspective philosophy.

So Polycarp Roebling loved Mulhausen and lived and died there, in spite of his son's effort to lure him to America. His sainted namesake had been burned at the stake for cherishing certain opinions. Nothing of the kind was likely to happen in Mulhausen, but no telling what the wild Indians might do in Pennsylvania or New Jersey, and Polycarp Roebling held opinions on a variety of subjects for which he was willing to smoke, but by no means willing to burn. Moreover he was accustomed to Mulhausen beer. It was not possible that beer like this could be found in all the world, and what was there in America to compensate for such a loss? It was also true that surprising things were happening in the United States. Nothing ever happened in Mulhausen, and a surprise of any kind was as disturbing to the old gentleman as a poke in the ribs; it was a species of impertinence. The grandson assures us that under no circumstances would his grandfather open a letter on the same day it was received, for no particular reason unless it were to tease the curiosity of his wife, whose temperament was of quite another sort.

Yes, the mother differed greatly from the father in character and disposition, and John A. Roebling was the son of his mother. To her Mulhausen was a pent-up Utica. She was a woman of tremendous activity, mental and physical. Deep in her soul she nourished ambitions which became tragedies through very hopelessness. She had borne four children, three sons and a daughter, but it was not until her youngest child, John, had displayed mental qualities to distinguish him even in the eyes of strangers that there dawned upon her the full significance of motherhood—its doom, its glory, its sacrifice, its triumph. Thenceforth ambition had but one goal, life but one object—the education of her boy. Through her industry and economy it was that John Roebling was enabled to graduate from the Royal University of Berlin, after a course at the Pedagogium of Erfurt; and when, shortly thereafter, he sailed for America, he carried

with him a patrimony large enough to insure his establishment.

At the Royal University of Berlin he had studied architecture and engineering with Steller and Rabe; bridge construction with Dietleyn, hydraulics with Eytelwein; languages in regular course, and philosophy under the great Hegel, who openly avowed that John Roebling was his favorite pupil.

Hegel is one of the epoch-makers of the world. In the realm of pure reason he ranks with Plato, Descartes, Spinoza and Kant. It is impossible to study him diligently and not be profoundly influenced by his teachings, and for a youth like John Roebling to have been brought into intimate contact with his dominating personality was at once a privilege and a calamity. It was a privilege because it opened the boy's eyes to the spiritual reality back of the "change and decay" of material phenomena; it was a privilege because he was taught to think independently and to rely upon the validity of his own conclusions. It was a calamity because it begat a pride and arrogance of opinion, and a frigid intellectuality that came near putting the heart of him into cold storage. We never feel the heat of a heart in Hegel's writings—only the pulse of thought. A manual of the Differential Calculus will appear a warm and sentimental treatise when compared with the merciless pages in which Hegel anatomizes the soul of man or the nature of the blessed God. Nothing that he has said will, by the manner of his saying it, make any one the braver for reading it, or the better for remembering it. The philosopher has almost if not altogether eaten out the man." And John Roebling was the favorite of this prodigy!

Hegel was a metaphysician; so was John Roebling—metaphysics was his dissipation. The time others spent in amusements, the reading of polite literature or impolite newspapers, John Roebling devoted to metaphysics. His son and biographer has a manuscript volume of thousands of pages, written by his father, called "Roebling's Theory of the Universe." I have not read this book—Heaven forfend that I should ever be asked to!

Hegel was an idealist; so was John Roebling, who scouted the atomic theory. His son, Washington, had studied the chemistry of Dalton and attempted to combat his father's arguments: but, says he: "Father would damn my atoms with loud and angry vociferation." This was hardly a pious way to resolve matter into spirit, but it was strictly Hegelian.

As a teacher Hegel differed utterly from the wise and gentle Froebel. He contended that it was dangerous to make education pleasant to children, and that they ought to be "broken in." To me this seems a harsh and ugly doctrine, but John Roebling took stock in it.

The laws of his household were Draconian, and prompt retribution followed their infraction. Even to be sick was culpable, just as being a common scold was formerly a misdemeanor, and the dereliction was remedied by like means, to wit, the ducking-stool; though it is fair to say that when guilty himself of being sick John Roebling took his own medicine.

I know not if it is a peculiarity of idealists, but those of you who have read Berkeley will recall his addiction to tar-water. Tar-water was the lustral water par excellence, the grand catholicon for the cure of everything. What tar-water was to Bishop Berkeley, cold water was to John Roebling. Every book ever published on Hydropathy John Roebling bought and studied, and applied its teachings according to his own notions—not with the cautious tentative methods of a physician, but in the large, generous, voluminous manner of an engineer. After all, what was hydropathy but a branch of hydraulics! With advacing years, however, Roebling's rigorous actions underwent many displacements, Hegel himself being displaced by Emerson.

John Roebling set sail for America in the year 1831, and landed on our shores a young man of 25, seemingly equipped for any battle that awaited him. He was a most accomplished gentleman. If a wiseacre had predicted his failure it would have been on the very ground that he was too accomplished, that his learning and talents were too various ever to focus in a particular vocation—especially the vocation of a farmer, which he had deliberately chosen. He had no knowledge of the science of farming; indeed, in his day, farming scarcely ranked as a science; nor had he any practical experience in the work itself. Nevertheless, he had chosen to become a farmer. He had graduated from the greatest university in the world as an architect and engineer—he was a scholar of wide reading; he was a philosopher of the transcendental sort, whom an American "hustler" would shy at as a crank; he was a musician of rare skill and temperament; he was the master of three languages, German, French and English; but what had all this to do with farming?

And yet he had chosen well, at least for the time being. In the first place, his choice had led to a thorough study of American history and geography. His knowledge of the topography, climatic and political conditions, the advantages and disadvantages of the different states in our Union was as accurate as if he had personally visited every one of them. The reasons set forth in his diary for locating as he did are most convincing. In the next place, he forthwith invested all his money in desirable lands at cheap prices, thus preventing its dissipation in some visionary enterprise. And so owning good farm lands well located he had, from the very start, insured his living and his independence.

The lands selected by him were in the western part of Pennsylvania, Butler County, about 25 miles from the new town of Pittsburg. Here he and a few of his compatriots purchased some 7,000 acres at an average price of $1.37 an acre, and founded the village of Germania, afterward called Saxonburg.

I may as well admit that John Roebling never became a first-class farmer. He made a living, to be sure, but it was a meagre living, and if by good luck he got a little money ahead he was sure to give it to some German emigrant in worse plight than himself. He even tried to supplement farming with other employments, such, for instance, as the breeding of canary birds. Fancy the engineer of Brooklyn Bridge raising canary birds for the profit in it! However, that peerless creation was not suggested by the wire cage of a canary, and he soon abandoned the enterprise as unproductive.

One day it occurred to Farmer Roebling that he might patch out his income if, between crops and during the winter he could obtain employment as an assistant engineer in making surveys, building canals and dams for slack-water navigation, and such work that was going on in his vicinity. His services were readily accepted, his real merits were soon recognized and it was not long before his knowledge and skill were in actual demand. Henceforth the farm was practically abandoned so far as John Roebling was concerned.

The ropes used to haul canal boats over the portage railways in western Pennsylvania were clumsy affairs, several inches in diameter, made of Kentucky hemp. They were costly and short-lived and a considerable item of expense. John Roebling opined that if a rope could be made of wire flexible enough to be wound on a windlass, it ought to cost little more than a hempen cable and would possess greater tensile strength with one-fourth the diameter. Moreover, it would outlast a dozen ropes woven from vegetable fiber.

No one in America had ever made a wire rope nor ever seen one. Roebling himself recalled an item in a periodical sent him from Mulhausen to the effect that some German inventor had produced a wire rope, and he concluded that what an indigenous German could do in the Fatherland, a transplanted German ought to do in America. At all events the idea was worth a trial.

So he built a rope-walk on his farm at Saxonburg, purchased a quantity of wire deemed suitable for his purpose, instructed his friends and neighbors in the art of rope twisting, and actually fabricated a wire rope that surprised his most buoyant expectation. It was a remarkable achievement and almost made him famous.

But he did not stop here. John Roebling's inventive mind evolved another idea, having its origin in a memory.

While yet a student at the university, one of his vacation tramps through northern Bavaria had brought him to the town of Homburg, where he saw for the first time a bridge suspended by chains spanning a small stream called the Regnitz. He had studied this structure, sketched it, and made it the subject of a thesis. Now he recalled his youthful essay and bethought him that if a cross-river aqueduct were suspended from wire cables (so much stronger than chains) it would eliminate piers and posts and other obstructions and leave the river to flow at its own sweet will.

He laid his plans and calculations before the engineers of a canal company about to cross the Alleghany River at Pittsburg, frankly admitting that what he proposed to do was without precedent, and in Germany would doubtless be frowned upon. But he insisted that his figures were correct and spoke for themselves, and that the advantages to be gained justified some risk. In short, that his scheme ought to appeal to the American spirit of shrewd adventure and daring enterprise.

He was ordered to do the work, and set about it knowing that the outcome would either place him in the forefront of American engineers or ruin him forever.

The undertaking was a success and led to many commissions of like kind, several of these suspension aqueducts being still in use, unimpaired, and seemingly good for all eternity.

Now a layman can see that a suspension aqueduct is nothing less than a suspension bridge, carrying an enormous load. John Roebling recognized the fact and pondered it; the whole world knows the results of that cerebration!

Before he had completed his first suspension bridge over the Monongahela, Mr. Roebling realized that he must have shops and machinery and possibly mills for drawing his own wire, and he further realized that Saxonburg was not a suitable location for such a plant. On the advice of his friend, Peter Cooper, whose iron foundries were at Trenton, he visited this Quaker city, studied its advantages, purchased a quantity of ground, and in 1849 removed his family from Saxonburg here, the journey requiring seven full days. Mr. Roebling was the architect of every building of his new plant, and the inventor and designer of nearly every piece of machinery that went into those buildings; for it w not until years afterward that he could be persua to employ an assistant engineer or draftsman.

How and where John Roebling found time to w all that he did—to attend scientific conventions an te voluminously for scientific journals; practice on n and piano; study metaphysics and pour forth h wn lucubrations in thousands of pages of manuscript; nt tools and machinery and make his own drawings he patent office; design bridges, canals and portag il- roads and himself superintend their constructi w he achieved all this, I say, bewilders imaginatio nd yet, each night before retiring, his daily journ nd note-books must be written up to the minutes; all if it took till morning!

It is related that once during the Civil War G ral Fremont sent for him and kept him waiting in the te- room, whereupon Mr. Roebling took a card and scr ed something to this effect: "Sir: You are keepi me waiting. John Roebling has not the leisure to it upon any man." His rule was to postpone a conf ce if the gentleman with whom he had an appoin nt happened to be five minutes late in keeping it.

It was, of course, this egregious value given to the instant that enabled John Roebling to do the wor of ten men; but to my thinking he overdid it. A man may become a miser of minutes as well as of pennies, and if we are immortal—why, what's the hurry? Time drives us all, I suppose, towards our chrysalis, the grave; some on the gallop as though running to a fire, some on a jog-trot as though out for an airing. Well, let each one of us employ his time as may best conduce—not to his pleasure, but to his happiness, a word of highest meaning; remembering that John Roebling had no time to be really happy—he worked too hard!

His planning of the Kentucky bridge, which was never built; the actual erection of the Wheeling bridge, the Cincinnati bridge, and even the wondrous bridge over Niagara Falls, were simply preliminary training for the monumental work that was to cost him his life while crowning it with glory.

The Brooklyn Bridge, commonly so-called, though still often referred to as "The Roebling Bridge," hyphenates Long Island and the island of Manhattan, and its construction made possible the Greater City of New York. When John Roebling presented his plans for this amazing structure the engineers of the whole world scoffed at them as audacious and absurd. If, said they, he should succeed in spinning his iron filaments over so vast a stretch, what useful purpose would he accomplish? Poof! Roebling's tangle of wires was a web to catch flies—he was courting the fate of Arachne in the fable! It was, in sooth, a work of unexampled difficulty—looming, portentous, Titanic! He fought his detractors inch by inch for the right to try, defending his ideas with such vehemence and courage that finally this right was given him. The great work, begun by himself after his own designs, was completed by his son. It is called today, in the candid admiration of mankind, the Eighth Wonder of the World.

Originally planned for a calculated load with a margin of safety, the exigencies of traffic have long since burdened this noble structure many times beyond its promise; and yet, within the last few weeks the board of experts appointed to examine its condition report that it is safe and unhurt and, if possible, has grown stronger with use. Luckily for the people of New York, John Roebling's promise was always less than his performance.

But Brooklyn Bridge is more than a crowded highway; it is a thing of art, beautiful in itself. From the bedrock of a mighty river, one hundred feet below its surface, bastions of masonry leap towards the clouds and kindle in the distance like shafts of light. The tenuous festoon that seems to cling to them floats in the air—an incredible gossamer woven in a dream. Yes, Brooklyn Bridge is beautiful! All the latent poetry of the mathematician—and in its highest reaches mathematics becomes divinest poetry; all the estheticism of the architect; all the musician's sensitiveness to harmony; all the mysticism of an idealist philosophy; whatever of faith feeling, reverence John Roebling cherished in his heart, was here voiced like a ringing cry. As if conscious of his pending doom his genius stands embodied in this final form—an inspiration visible—a soul's bid for immortality!

THE LARGEST VERTICAL GAS ENGINE in the world was started June 6 at the works of the Castner-Kellner Alkali Co., Ltd., Runcorn, Eng. It is a 1,000 B. HP. engine of standard vertical type, supplied by the British Westinghouse Co. and is connected to a direct-current generator made by the same firm. The cylinders are placed in pairs over four cranks, which arrangement is said to give a most even turning moment. All valves are operated positively by straight push-rods moved directly from the cam shaft. No water cooling is used for pistons, valves or cam shafts in order to avoid danger of frequent breakage. Forced lubrication is employed throughout.

SEWAGE PURIFICATION AT WASHINGTON, PA.

By R. WINTHROP PRATT.*

The Borough of Washington, Pa., is located some 25 miles southwest of Pittsburg. It is a thriving manufacturing community, as well as an important oil and coal center. The borough is on the upper portion of the drainage area of Chartiers Creek, which stream ultimately discharges into the Ohio River a few miles below Pittsburg. The topography is representative of that of southwestern Pennsylvania, being decidedly hilly.

Washington at the present time has a population of approximately 23,000, and this is rapidly increasing. The population five years hence is estimated at 30,000; and if the proposed annexation of the borough of East Washington is accomplished, this would add two or three thousand more.

The public water supply of Washington is derived from a small stream, a few miles east of town, and is purified by mechanical filters. Water is furnished to nearly all the inhabitants, and the approximate average daily consumption is 1,000,000 gals. The works are owned by a private company.

PRESENT SEWERAGE SYSTEM.

Washington has a fairly complete system of sewers, built in approximate conformity to a general plan drawn by the late Colonel Waring some 20 years ago. The total length of sewers is at present about 18 miles. This includes some 12 miles of 6-in. laterals, 2 miles of 8-in. laterals and 4 miles of main sewer, ranging from 12 to 20 ins. in diameter.

The sewerage system accommodates all the thickly built up portions of the city, covering an area of 1½ sq. mi. There are at present 4,000 house connections, representing some 18,000 or 20,000 people. The system is designed to be used for domestic sewage only; but the general practice, in spite of an ordinance to the contrary, has been to connect the down-spouts from roofs with the sewers. This practice has resulted in surcharging the sewers at every heavy storm, and forcing the water out through certain manholes. Recently, however, provision has been made for more rigidly enforcing the ordinance forbidding roof-water connections. Surface water is conveyed to the creek principally by the gutters of the paved streets, most of which have steep grades.

The sewers are not underdrained to prevent the infiltration of ground water. Such underdrainage is not necessary with the lateral sewers, which are located on the steep hillsides, but would have been desirable with the main sewer, which is located in the valley. The sewers are ventilated through the manhole covers in the streets, and through the soil pipes in the houses. They are flushed automatically and are inspected regularly by the street department every two or three weeks. The principal difficulty in maintaining the system has been due to stoppages caused by the growth of roots.

The main sewer follows closely the course of Chartiers Creek, through the center of the town, for a distance of about two miles to a point near the northerly corporation line, where it formerly discharged into the creek. At this point it is 15 ins. in diameter. Four years ago this 15-in. main sewer was continued some two miles down the valley by means of an 18 and 20-in. pipe sewer, following the creek, to an area of land near Arden Station, purchased at that time for sewage disposal purposes. [See general plan accompanying Mr. R. F. Proctor's article on contractors' plant, immediately following this article.—Ed.] Although plans had been prepared for constructing this extended main sewer by a more direct route, and at a higher level, these plans were not followed by the officials in charge at the time. The result was that the existing outlet was made too low to permit the sewage to be treated, by properly constructed filters, without pumping.

Aside from this unfortunate procedure in regard to the main sewer, Washington is fortunate in having adopted and carried out the present plan of sewerage. By using the separate system money has already been saved in construction, and the problem of purifying the sewage is now much simplified.

*Consulting Engineer, Columbus, Ohio.

OLD PURIFICATION PLANT.

On the tract of land above mentioned, on the westerly side of the creek, near Arden Station, there was built, at the time of the extension of the main sewer, a plant to treat the sewage before discharging it into the stream. This plant was in use until a few months ago. It consists of a settling or septic tank 20 ft. wide, 200 ft. long and 7 or 8 ft. deep, thus holding 240,000 gals., or 6 hours' flow, based on the present daily yield of sewage. Cross walls were located at 50, 100 and 150 ft. from the inlet end. The sewage, without screening or previous treatment of any kind, entered the tank through a trapped inlet, 2 ft. below the surface, and was drawn off at the opposite end through a similar trap.

At the outlet of the tank there was a bed of broken limestone, 15 ft. wide, 100 ft. long and 3 or 4 ft. deep. The plan was to have the effluent from the tank filter continuously in a lateral direction through this broken stone. The stone, however, soon became clogged so that the sewage simply flowed along the top and discharged into the creek unchanged.

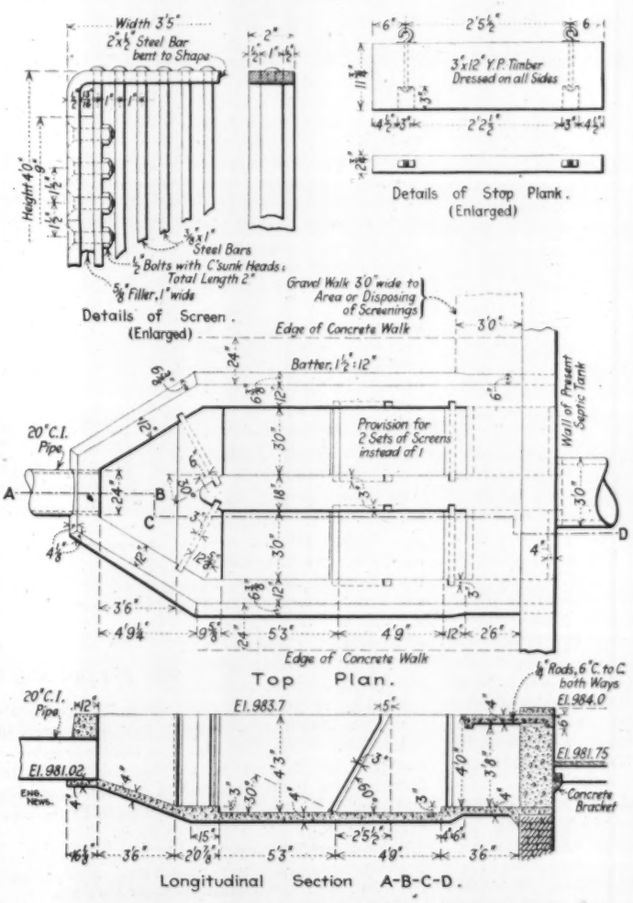

Width 3'5"
2"x½" Steel Bar bent to Shape
Height 4'0"
⅝"x1" Steel Bars
½" Bolts with C'sunk Heads; Total Length 2"
⅝" Filler, 1" wide
Details of Screen. (Enlarged)
3"x12" Y.P. Timber Dressed on all Sides
Details of Stop Plank. (Enlarged)
Gravel Walk 3'0" wide to Area or Disposing of Screenings
Edge of Concrete Walk
Batter, 1½":12"
20" C.I. Pipe
Provision for 2 Sets of Screens instead of 1
Wall of Present Septic Tank
Top Plan.
20" C.I. Pipe
El. 983.7
El. 981.02
End of Conc.
½" Rods, 6" C. to C. both Ways
El. 984.0
El. 981.75
Concrete Bracket
Longitudinal Section A-B-C-D.

FIG. 1. DETAILS OF SCREEN CHAMBER, SEWAGE PURIFICATION WORKS, WASHINGTON, PA.

The action of the septic tank during the two or three years of operation of this plant is interesting. The effluent during the first two or three months, it is said, was clear and comparatively inoffensive. With continued use, however, the tank rapidly filled; so that its capacity after two years' use, when inspected by the writer, had decreased 50% or more. The inlet end of the tank was occupied by 8 ft. or more of solid matter. The scum at the inlet end extended considerably above the water level, and the upper 2 ft. was hard and tenacious, being sufficiently strong to bear the weight of a man. The scum at the middle and at the outlet end of the tank was of a more pasty consistency. The sewage passed through the scum and solid matter at the upper end of the tank in narrow channels, and apparently this material served as a sort of strainer or filtering medium, constantly increasing in bulk.

There was but little accumulation of sludge in the bottom of the tank, indicating that it had filled from the top downward, rather than from the bottom upward, as is usually the case. This action was doubtless due to the extremely putrefactive and gas-forming nature of the suspended matter in the sewage; which, as discussed below, contained large amounts of slaughter-house refuse. The top of the scum contained what appeared to be brewery grain, which would indicate that some brewery refuse had been discharged into the sewers. The accumulations in the tank could have been largely prevented if the sewage had been subjected to preliminary screening.

The effluent from the tank, after the first few months, became very black and foul in appearance, and emitted excessively offensive odors. These were, undoubtedly, largely due to the decaying animal matter from slaughter-houses. In spite of the foul effluent it was found, by analysis, that a considerable portion of the suspended matter was removed from the sewage during its passage through the tank; and this would be expected, from the rapidity with which the solid matter accumulated in the tank.

PRESENT POLLUTION OF CHARTIERS CREEK.

Chartiers Creek, above the present sewer outlet, has a drainage area of some 15 sq. mi. In the valley below Washington are several boroughs and two public institutions. Pasture land abuts the creek in many places. There are numerous coal mines along the stream, the drainage from which sometimes renders the lower portion acid and unfit for stock watering or for domestic use. For several miles, however, immediately below Washington, the stream is probably never acid.

From a series of discharge measurements made by the writer, and by comparison to similar streams which have been gaged by the U. S. Geological Survey, the average dry-weather flow of the stream below Washington was estimated at 12 cu. ft. per sec. The minimum flow is probably 3 cu. ft. per sec. It will be seen from this that the ability of the stream for disposing of sewage by dilution is not great.

Chartiers Creek is the natural drainage channel for Washington, and receives all the surface drainage from several miles of paved streets within the city limits. In addition, it receives more or less oil and manufacturing waste, as well as the foul effluent from an inefficient sewage disposal plant at East Washington, located just above the city. The stream, in the lower part of and below the city, receives acid-iron waste from tin-plate mills, which has the effect of badly discoloring the water. Further down stream the sewage from an oil refinery causes more pollution.

It will be seen from the above that before the stream reaches the outlet from the present sewage plant it is already somewhat polluted. The additional pollution, however, caused by the

effluent from the septic tank above described, makes the stream very offensive, during its low stages, for several miles below Arden. Complaints to the State Health Department and lawsuits brought against the city by property owners along this portion of the stream had their due effect in causing the officials of Washington to provide for an adequate sewage purification plant.

COMPOSITION OF THE SEWAGE.

In connection with the preliminary investigations of the problem, made by the writer in 1906, there was conducted a 24-hour test of the quantity and quality of the sewage as discharged from the main sewer. The effect of the septic tank on the sewage was also studied.

During this test there were collected, at one-half hour intervals, samples of the crude sewage from the main sewer above the septic tank, and also from the outlet of this tank. These half-hourly samples were mixed proportionately to the flow of sewage, and from them were formed three composite samples: one representing the crude day sewage, one representing the crude night sewage, and one representing the effluent from the septic tank. These samples were collected and analyzed by or under the direction of Mr. A. Elliott Kimberly, of Columbus, O. Most of the determinations were made in the field, thus eliminating any error due to change in composition during shipment of samples.

The analyses showed that the Washington sewage may be classed as abnormal. It is not high in nitrogen, but is very strong in suspended matters and fats, compared to the sewages of other cities. An especially large quantity of suspended fatty material, presumably from slaughter-houses, was noted in the sample representing the night flow of sewage. This slaughter-house waste, and possibly to a certain extent other industrial wastes, complicate the composition of the sewage and tend to make its treatment more difficult. As stated below, steps have been taken to control the use of the sewers by the slaughter-houses.

Table I. gives the analyses of Washington sewage as compared with the analyses of sewages from a number of other cities. Table II. gives the different constituents in the sewage of Washington and other places, on the basis of grams daily per person contributing sewage, thus eliminating the variable factor of volume of sewage.

In considering these tables it should be borne in mind that Washington sewage analyses represent but 24 hours' flow, while the figures for other places cover longer periods. Nevertheless, from occasional inspections of the character of the Washington sewage since the analyses were made, and from the action of the septic tank, discussed above, it would seem probable that the Washington analyses are fairly representative.

FLOW OF SEWAGE.

In order to gage the actual amount of sewage to be treated there was installed, during the above-mentioned test, at a point 1,000 ft. above the outlet, a large wooden box containing a 24-in. weir, through which the entire flow of sewage could be diverted by inserting a plug in the sewer and causing the flow to pass out through an opening in the side of a manhole. A number of flow observations were taken, both night and day, during the test.

Later there was installed at the same point an automatic recording device, operated by a seven-day clock, similar to the type used by the Massachusetts State Board of Health. The automatic device has been in continuous operation to date, has required attention but once a week and has given excellent results.

The observations to date have shown that the average dry weather flow of sewage is approximately 1,000,000 gals. per 24 hours, which, incidentally, about equals the daily water consumption. During times of wet weather the average daily flow increases to 3,000,000 gals. The day flow during dry periods is about twice as much as the night flow. The dry weather flow per capita, based upon the total population, is 44 gals. per day; and the flow per person contributing sewage is 50 gals. per day. An inspection has shown that no large volume of water is contributed by any of the industrial establishments.

PLANS FOR NEW WORKS.

Considering the local conditions at Washington, it was decided that a plant which would purify the sewage to the non-putrescible stage would be satisfactory. Accordingly, plans were drawn for a plant consisting of septic tanks, sprinkling or percolating filters and a final sedimentation basin. The sewage can be treated in the latter, with chemicals, if a higher degree of bacterial purification should be desired in the future. The plant includes a pumping station and machinery for raising the sewage to the new septic tanks.

These plans were approved by the Pennsylvania State Health Department upon several conditions, the principal of which were:

That all storm and roof waters be excluded from the sewerage system, and that the local authorities submit a plan therefor to the Health Department Jan. 1, 1909.

That the borough council cause to be built on individual property, proper receptacles for the reception of all matters whatsoever prejudicial to the operation of the public sewerage system and disposal works.

That the borough authorities place some one in responsible charge of the disposal plant and that there shall be continuous attendance at the plant night and day.

That daily reports of the operations at the works shall be kept on forms to be provided by the Commissioners of Health.

That no pathogenic material from any laboratory shall be discharged into the sewer system, and that the proper authorities cause these wastes to be incinerated on the premises.

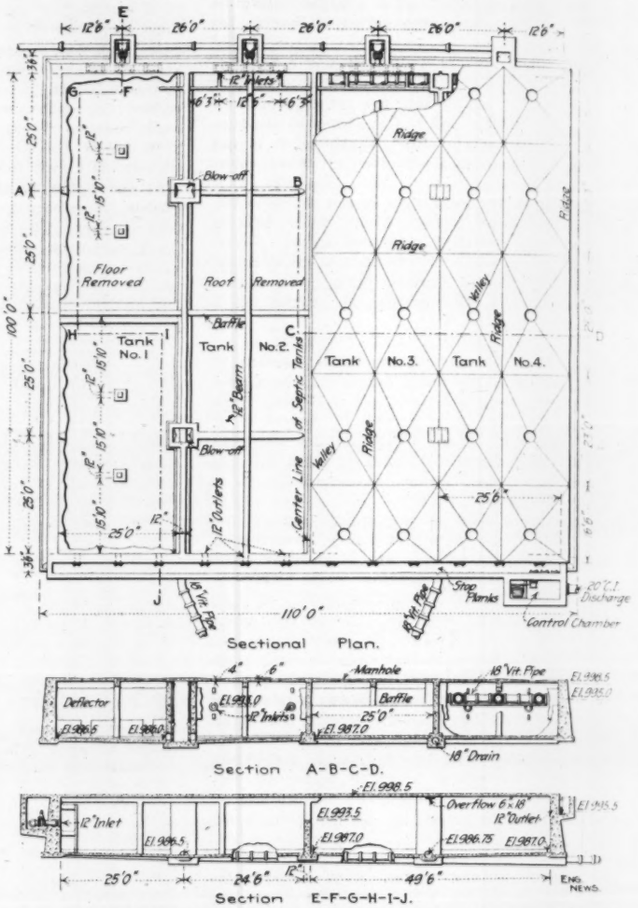


FIG. 2. PLAN AND SECTIONS OF SEPTIC TANKS, WASHINGTON, PA.

The contract for the new works was let in November, 1906, and construction was commenced in March, 1907. It is expected that the plant will be completed in September, 1908.

CONTROL OF MANUFACTURING WASTES.

—The State Health Department, with the assistance of the writer, carefully considered the matter of allowing slaughter-house wastes to enter the sewers. The borough has been directed (as shown by one of the conditions of approval), as a matter affecting the efficient operation of the sewage plant, to forbid the further discharge of such wastes unless first subjected to some approved process for removing the suspended matter and grease. This can be easily regulated by means of an existing ordinance requiring the installation of a grease trap of approved design when deemed necessary by the council or the borough engineer.

In the case of slaughter-houses, a grease trap, to be efficient, would have to assume the proportions of a tank. The principle, however, is the same, as far as the ordinance is concerned; and it is believed that a settling tank holding some 24 hours' flow, with outlet at mid-depth and with provision for using chemicals if necessary, would serve to clarify the wastes sufficiently to permit

TABLE I.—ANALYSES OF SEWAGE OF WASHINGTON, PA., AND OF OTHER MUNICIPALITIES.

	Parts per 1,000,000.						
	Oxygen consumed.	Nitrogen as Organic.	Nitrogen as Free Ammonia.	Chlorine.	Suspended matter. Total.	Suspended matter. Volatile.	Suspended matter. Fats.
Washington, Pa.	57	17.8	10.0	90	363	265	198
(Day sewage, 7 a.m.—11 p.m., July 3-4, '06)	*37	7.4	...	..	.....	.....	.....
	†20	10.4	....	..	.....	.....	.....
Washington, Pa.	70	11.4	8.4	74	4,175	2,064	2,022
(Night sewage, 11 p.m.—7 a. m., July 7-9, '06)	*42	4.2	....	..	....	....	....
	†28	7.2	....	..	....	....	....
Washington, Pa.	61	15.7	9.5	85	1,633	864	806
(Average sample)	*38	6.3	....	..	....	....	....
	†23	9.4	....	..	....	....	....
§Mansfield, Ohio	19	2.6	3.8	60	122	....	....
(Av. 4 12-hr. samples, July 7-9, '05)	..	0.3	....	..	....	....	....
	..	2.3	....	..	....	....	....
Marion, O.	59	39.0	19.0	..	167	....	48
(Av. 3 12-hr. samples, May, 1906)	*27	23.0	....	..	....	....	....
	†32	16.0	....	..	....	....	....
Columbus, O.	56	9.7	11.5	67	215	....	27
(Sew. Purif. Rep. p. 28, av. 282 samples)	*28	3.6	....	..	....	....	....
	†28	6.1	....	..	....	....	....
‖Lawrence, Mass.	40	12.0	43.9	101.2	189	....	60.8
‖Framingham, Mass.	47	12.0	31.7	69.9	212.4	....	....
‖Marlboro, Mass.	44	7.3	31.5	59.0	137.5	....	....
‖Natick, Mass.	33	6.0	14.8	59.5	55.6	....	....
Washington, Pa.	47	4.9	12.5	46	119	126	100
(Septic Tank Effluent)	27	1.7	....	..	....	....	....
	20	3.2	....	..	....	....	....

Note—Washington sewage contained no nitrates in day sample and .02 part in night sample.
*Dissolved.
†Suspended.
§Dissolved Oxygen 1.9
‖1903 Annual Report Mass. State Board of Health.

TABLE II.—ESTIMATED QUANTITIES OF PRINCIPAL CONSTITUENTS OF SEWAGE OF WASHINGTON, PA., AND OTHER MUNICIPALITIES IN GRAMS PER CAPITA DAILY.

	Oxygen consumed.	Nitrogen as Organic.	Nitrogen as Free Ammonia.	Nitrogen as Total.	Chlorine.	Supended matter Total.	Supended matter Volatile.	Fats.
Washington, Pa.	15.4	4.0	2.4	6.4	21	386	215	200
Av. of ple 24 hrs.	14.6	9.6	4.7	15.3	..	41	20	11.8
Marion, Ohio	30	6.2	8.2	14.4	32	98	47	19.1
*Columbus, Ohio								
Massachusetts cities (having separate systems of sewers)	13.0	4.7	5.0	9.7	16	49	38	...

*Taken from Report on Sewage Purification at Columbus, Ohio, 1905.

discharge into sewers without detriment to sewage purification.

The brewery wastes were investigated; but were found to be so small in amount, and inoffensive in character, that no restrictions were placed on their discharge into the sewers.

CHOICE OF SITE.—Another feature studied by the writer in his preliminary report was the choice of a site for the new purification works. As discussed above, the borough had already purchased a large tract of land (some hundred acres), but only a few acres of this, immediately along the creek, could be utilized for sewage purification purposes, the remainder being too hilly. After investigating the three or four possible sites which were available within reasonable distance of the city, it was decided that the most suitable one was the area immediately across the creek from the land already owned by the borough. Accordingly, a tract of some 17 acres was purchased. This area affords ample room for increasing the plant two or three times, and also ample facilities for sludge disposal. The nearest dwelling is the County Children's Home, located 1,000 ft. distant and 50 ft. above the location of the new filters. A few houses near the Arden railroad station are located within nearly the same distance from the plant. An interurban electric car line forms, in part, the southerly boundary of the area. The new site is very satisfactory in every way; especially so, when the topography of the Chartiers Creek valley and the comparative scarcity of sites is considered.

CAPACITY.—The nominal capacity of the new plant is 2,000,000 gals. of sewage daily; or the sewage from about 30,000 people. The plant may be operated at double the nominal rate for short periods; and as the maximum carrying capacity of the present main sewer is only about 3,000,000 gals. per day, the plant will probably handle all the sewage which will be brought to it under present conditions.

SCREEN CHAMBER.—Just above the entrance to the old septic tank, and adjacent thereto, a screen chamber (Fig. 1) is being constructed. The sewage from the present main sewer will enter it at the upper end, and pass through it into the old septic tank, which is to be remodeled for use as a pump well. The screen chamber is a concrete structure about 20 ft. long, 4 ft. deep and 7½ ft. wide, a longitudinal wall dividing it into two channels each 3 ft. wide. Either one or both of these channels may be used, the sewage being diverted from one to the other by means of stop-planks. In each channel are two screens constructed of parallel steel bars; the first screen has openings of ⅝ in.; and the second, openings of ¼ in. The screens are inclined down stream at an angle of 60° with the horizontal.

It will be noted that the open space of these screens is comparatively small, and that consequently they will require cleaning at frequent intervals. It is believed, however, that under Washington conditions this frequent cleaning of the screens will entail no great additional expense, and that such screening will serve to remove the coarser pieces of the slaughter-house refuse that now enters the sewers, in case the borough officials should fail to permanently control such discharge at the slaughter-houses themselves. The screenings are to be conveyed in a wheelbarrow to an area reserved for their disposal, about 400 ft. from the screen chamber.

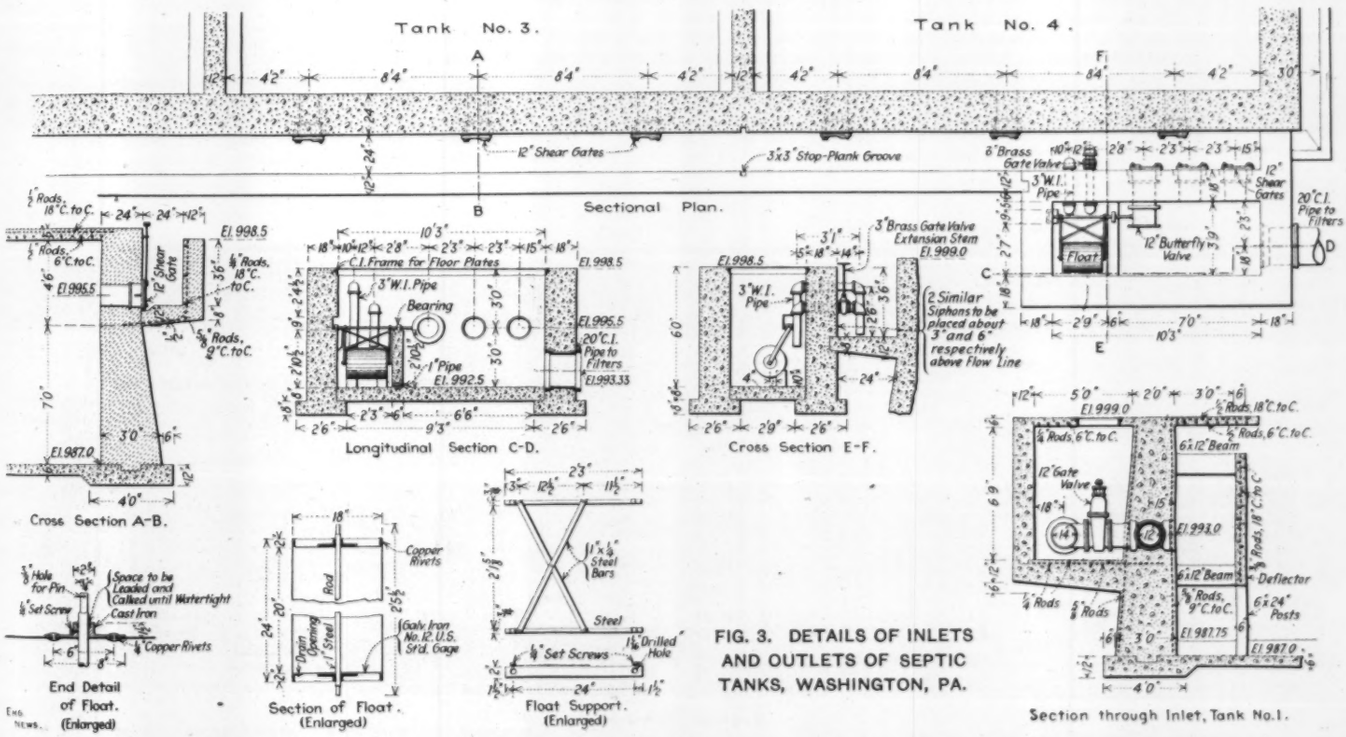


FIG. 3. DETAILS OF INLETS AND OUTLETS OF SEPTIC TANKS, WASHINGTON, PA.

PUMP WELL.—The upper portion of the old septic tank, into which the screened sewage will discharge, will be converted, by means of a new cross wall, into a pump well, or equalizing basin, 50 × 20 ft., by about 4 ft. deep. This basin will serve to equalize, to a certain extent, the variations in flow of sewage, and will enable the pumps to operate at a more constant rate. The outlet of the old septic tank will now serve as an emergency overflow from the pump well.

INVERTED SIPHON.—Leading out of the bottom of the pump well is a 20-in. cast-iron pipe, which is continued by a 16-in. inverted siphon 40 ft. long, passing under the creek. The difference in level between the two ends of this siphon is 1 ft. The lower end discharges into a 20-in. vitrified pipe line, laid in concrete, and about 300 ft. long, extending to the suction well, which is adjacent to the pumping station. This suction well is 28 × 5½ ft. × 8 ft. deep below the level at which the sewage will flow into the creek through emergency overflow.

PUMPING PLANT.—The pumping station is 28 × 50 ft. in plan, of pressed brick with sandstone trimmings. It has steel roof trusses and slate roofing. The brickwork rests on heavy concrete foundation walls, which form the lower portion of the station in which the machinery is located. The engine floor is 4 or 5 ft. below the present ground level, and some 6 ft. below the flood level of the creek. The pumps are set in a pump pit about 3 ft. below the engine floor.

The pumping machinery is to consist of one 8-in. and three 5-in. horizontal Brooks Centrifugal pumps, driven by three Gardner gas engines. One of the 5-in. pumps, known as the sludge pump, is reserved for pumping sludge from the final sedimentation basin, and for draining the pumping station if this should be necessary. Both of the 5-in. sewage pumps are of the slow-speed type. The sludge pump, together with the 8-in. centrifugal sewage pump, are connected by belts to either side of a 25-HP. gas engine. (It is assumed that both of these pumps will never be needed at the same time.) The distance from the pump shaft to engine shaft is 14 ft. Either pump can be thrown in or out by means of a friction clutch. Each of the remaining 5-in. sewage pumps is connected by a belt to a 15-HP. gas engine.

The sewage pumps will operate against an actual head of about 20 ft. It is expected that one of the 5-in. pumps will be sufficient to handle the average dry weather flow of sewage, and these pumps will be used on alternate days. There is thus provided, in duplicate, pumping capacity enough to handle the dry weather flow, with ample reserve capacity for the storm flow, up to the carrying capacity of the main sewer.

In addition to the machinery for handling the sewage, there is provided equipment necessary for securing a water supply from two 8-in. driven wells, 100 ft. deep, located near the pumping station. This equipment consists of a vertical gas

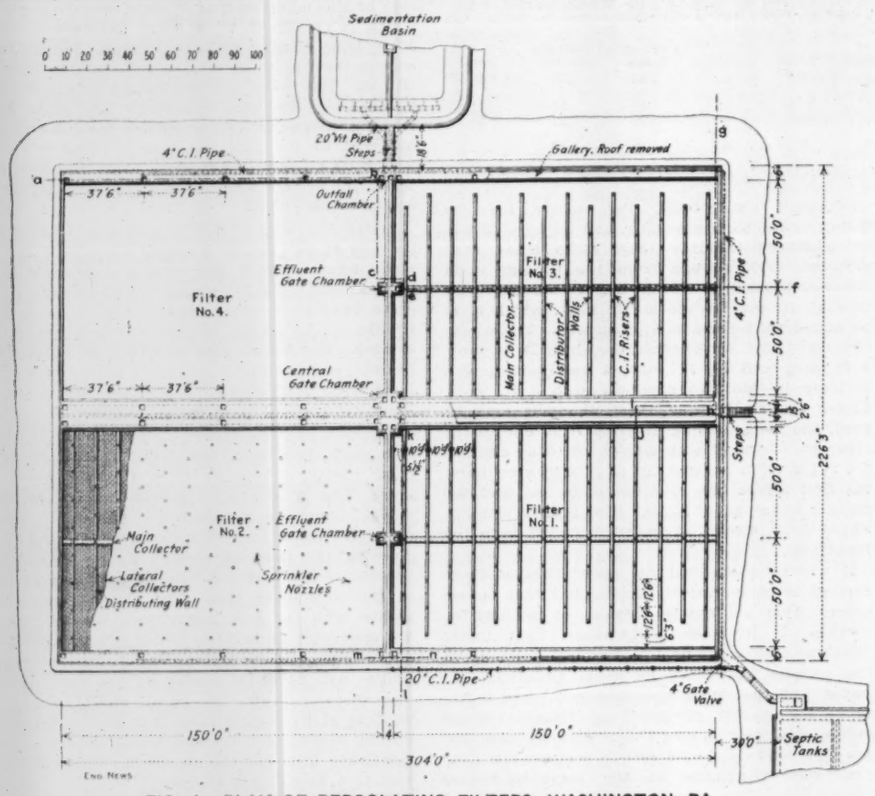


FIG. 4. PLAN OF PERCOLATING FILTERS, WASHINGTON, PA.

engine direct connected on one side to an air compressor having a capacity of 50 cu. ft. of free air against 50 lbs. pressure; and on the other side to a triplex pump having a capacity of 150 gals. per min. against 60 lbs. pressure. The water from the wells is to be forced by air lifts into the pump well, from which the triplex pump will raise it into a storage tank, holding 5,000 gals., located on a hill about 20 ft. above the station floor. The water from this tank will flow by gravity through the cooling jackets of the gas engines, and discharge back into the pump well. The storage tank can be filled in 30 minutes, and will hold sufficient water for cooling purposes to last at least one day with three engines running.

Valves are so placed that water for general purposes, such as flushing the septic tanks and cleaning out the underdrains of the filters, can be obtained direct from the pump well and delivered into the water system at 60 lbs. pressure. During direct pumping the storage reservoir is cut off from the pump so that no extra pressure is brought upon the cooling system.

SEPTIC TANKS.—The septic tanks (Figs. 2 and 3) are located upon high ground near the southerly boundary line of the disposal site, and the sewage is lifted to them through a 14-in. force main. The tanks are formed by a concrete basin about 100 ft. square and 12 ft. deep. This basin contains three parallel dividing walls which form four separate tanks, each [illegible] x 100 ft. A 12 x 14-in. T and 12-in. gate is placed on the force main at the center of the upper end of each tank, and provision made for discharging the sewage into the tank through a 12-in. vitrified pipe embedded in the concrete wall, and terminating in two 12-in. elbows, each 6 ft. from the side of the tank. When operating "in parallel" the sewage is drawn off near the surface of each tank through three 12-in. outlets, controlled by shear gates, and passes into an open channel extending along the outside of the lower end of all four tanks. A deflector or baffle wall is placed near the inlet and outlet of each tank.

In order that the sewage may have a greater velocity, and greater distance to travel than would be the case if admitted in equal portions to each of the four tanks, there have been provided necessary openings and gates so that sewage passing forward through Tank 1 or Tank 2, or both, may be directed backward through Tank 3 into an 18-in. vitrified pipe at the upper end of this tank, through which it may be passed to the upper end of Tank 4, and thence forward through this last tank. In other words, the tanks may be operated in parallel or in tandem, as may be found most desirable with reference to handling and disposing of the sludge.

Each tank has a nominal capacity of 200,000 gals. below the highest flow level, which means a total capacity of 800,000 gals. Based on a nominal capacity of 2,000,000 gals. per day for the entire plant, the tanks would hold about 10 hours' flow, or 7½ hours with one tank out of service. As will be discussed below, the flow line of the tanks will change continually between limits which can be fixed by the regulating device in the control chamber. The maximum limits correspond to an average depth of from 8 to 10½ ft. in the tanks. Elasticity in operation may thus be secured.

The tanks are to be covered by a flat reinforced-concrete roof. Each tank is to have ten 2-ft. manholes, with perforated covers. This apparently large number of manholes is thought to be well worth while on account of the advantage which they afford, based on the writer's experience, when the tanks are being cleaned or inspected. The matter of using covered or uncovered tanks was given considerable thought, and it was decided that on account of the proposed scheme to make a park of the land adjacent to the disposal works, and because the tanks are not far from an electric car line, covered tanks would present a more attractive appearance. Other probable advantages were also given weight.

SLUDGE DISPOSAL.—A cross wall, 6½ ft. high, extends across the center of each tank, thus

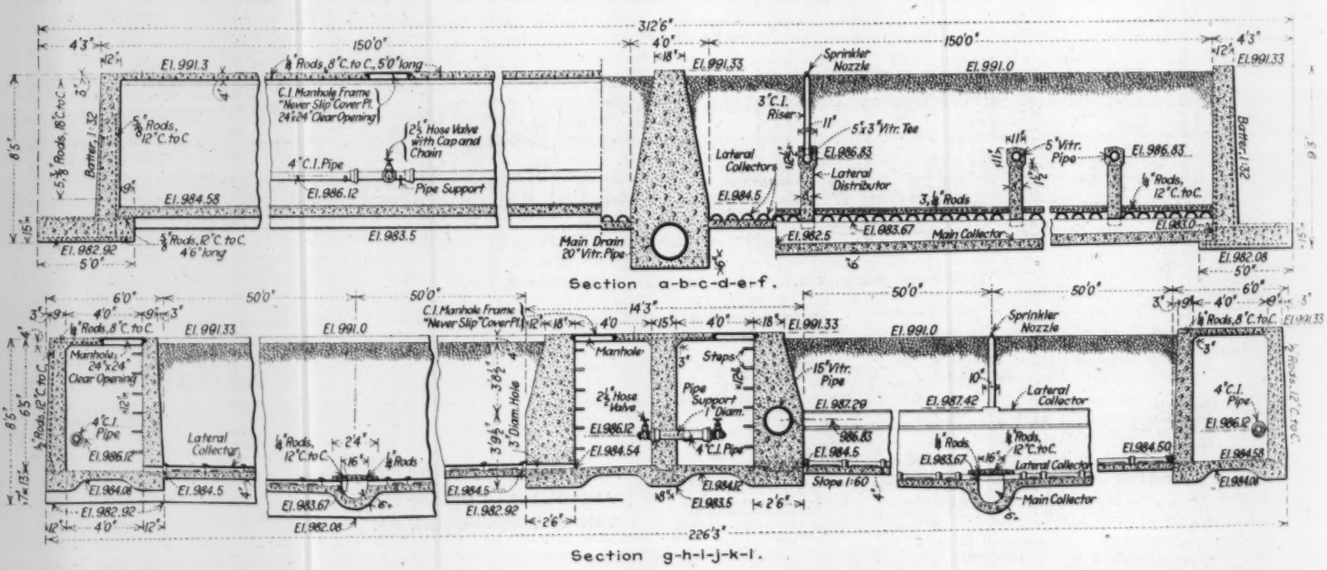
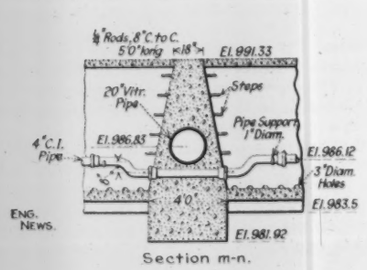


FIG. 5. SECTIONS OF PERCOLATING FILTERS, WASHINGTON, PA.



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forming below the level of the top of this wall, eight separate compartments, each 50 × 25 ft., any one of which can be drained from the bottom without disturbing the contents of the remaining compartments or tanks. The sludge thus drained out will be discharged through an 18-in. vitrified pipe to an area of about 1½ acres bordering the creek, which has been graded for sludge disposal purposes. This same area will be used for the disposal of the deposits from the bottom of the final sedimentation basin, such deposits being pumped to the area. The water system is extended to the septic tanks so that a stream of water under 50 lbs. pressure will be available for flushing out the tanks and breaking up the scum if necessary.

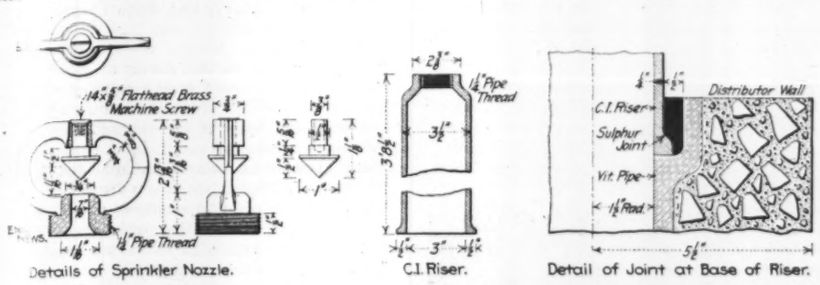


FIG. 6. DETAILS OF SEWAGE SPRINKLER NOZZLE AND RISER THERETO.

CONTROLLING DEVICE.—An important feature in the use of septic tanks and sprinkling filters is the method of controlling the flow to the filters so that there will always be sufficient head to obtain proper distribution by the sprinkling nozzles. If the flow to the filters is subject to the same variations as the flow to the tanks there will be times when the nozzles will afford poor distribution. At Washington a device (Fig. 3) has been installed which, when the head on the sprinklers becomes small, cuts off all flow from the septic tanks, allowing them to act as storage tanks until the level rises approximately 3, 6, 12 or 24 ins., as may be desired. When the desired level is reached a small stream of sewage is siphoned out through a 3-in. pipe into the float chamber. As this chamber fills, a float rises and opens a butterfly valve on the outlet from the tank. The surplus sewage then passes out in such increased quantities as to provide ample head for proper distribution for a period depending on the rate of application. When the surplus sewage has been drawn off, the float chamber drains, and the float is lowered and closes the outlet from the tanks.

FILTERS.—The sprinkling filters (Figs. 4 to 9), are four in number, each being 100 × 150 ft. They are formed by concrete walls on all sides, and contain, on an average, 6 ft. 10 ins. of broken stone. At nominal capacity, the rate of filtration will be 1,400,000 gals. per acre per day. The elevation of the surface of the filtering material is 6 ft. below the minimum flow line in the septic tank; and the bottom of the filters is slightly below the highest flood level in the creek. The septic tank effluent is conveyed through a 20-in. cast-iron pipe and a 20-in. vitrified pipe, the latter being within one of the concrete dividing walls, to a central gate chamber located at the intersection of the dividing walls of the four filters.

From this gate chamber extend four 15-in. vitrified main distributing pipes, one to each filter. Each of the main distributors is about 2½ ft. above the filter floor, and is imbedded in the concrete wall which forms the side of the filter. Branching from each, at intervals of 10¾ ft., are lateral distributors of 5-in. vitrified sewer pipe, enclosed in small concrete walls. Located every 12½ ft. along each lateral distributor are 3-in. cast-iron risers, each extending to the surface of the filtering material, on the ends of which are placed the sprinkling nozzles. The risers are joined to the vitrified distributors by means of sulphur joints, these having been found more satisfactory for the purpose than lead joints. In general design the lateral distributors and risers are similar to those at Columbus, O.; and due acknowledgment is made to the designers of that plant.

The bottoms of the filters are of concrete, 4 ins. thick, and slope at the rate of 1 in 60, to a 16-in. central semicircular collector, extending longitudinally through the center of each filter. The grade of this collector is 1 in 300. It is spanned by a concrete slab which supports the filtering material.

The lateral collectors or drains lie at right angles to the central collector and discharge into it. The laterals are 10½ ins. c. to c. and consist of 2-ft. lengths of 5-in. half round tile, with bells. The upper ends of these lateral drains are accessible from the inside of the galleries, as explained further on. The tile are placed in an inverted position on the finished floor and the edges are slotted to provide freer entrance for the liquid. A total of 61,000 ft. of this tile is used for the 1½ acres of filters.

The main effluent pipe is placed beneath the main cross dividing wall and receives, at four points, the effluent from the central collectors of the four filters. A sluice gate placed in a gate chamber controls the discharge from each filter. This will permit the operator to flood the filters, with the idea of flushing out some of the deposited solid matter, and will enable the plant to be operated on the contact principle.

Along both sides of the filters, extending longitudinally, are covered galleries 6 ft. high and 4 ft. wide. The upper ends of the lateral underdrains extend into these galleries. This construction affords an opportunity for flushing or cleaning out the underdrainage system by forcing the clogging material into the central collector by means of a stream of water, or cleaning rod, without removing the filtering material. It also tends to admit air to the filtering material. In these galleries are located the water pipe lines for flushing. The gallery construction is somewhat similar to that proposed by the board of consulting engineers, in a preliminary report, for Baltimore, Md.

The sprinkling nozzles (Figs. 6, 8 and 9) used are of the type used at Columbus, O., but have a 7/16-in. orifice instead of a 9/16-in. orifice, as at Columbus. They will be operated under a head varying from nearly 7 ft. down to 2 ft. The average rate of discharge of each will be approximately 10 gals. per min. when operating. These nozzles have already been tested in place at Washington by pumping into the distribution system, and were found to produce a very satisfactory and finely divided spray, which, under the fluctuating head, appeared to thoroughly cover the surface of the filter.

FILTERING MATERIAL.—The filtering material, with the exception of the upper 6 ins., is composed of a low-grade limestone taken from a quarry located on the borough property about 1,000 ft. from the plant. The quarry was opened by the contractor especially for this work. The stone is crushed into two sizes, the larger grade being 2½ to 4 ins., and the smaller 1 to 2½ ins.

A chemical analysis of the stone by Mr. L. V. Parker, of Columbus, O., gives the following results:

Lime ($Ca\ CO_3$)	39%
Silica ($Si\ O_2$)	34%
Carbonate of magnesum ($Mg\ CO_3$)	20%
Iron ($Fe_2\ O_3$)	8%

This stone is very close grained and hard, and upon comparative tests absorbed much less water than other limestones of durable quality. It is, however, somewhat liable to crack and break up when exposed directly to snow and ice. For this reason it was thought better to have the upper 6 ins. of the filter composed of a grade of stone which would not be affected by the weather. Such stone will probably be secured from some of the quarries in Ohio. When the contract was let, an alternate price of $1.60 per cu. yd. (instead of $1.20 for the local stone) was agreed

Fig. 7. Laying Lateral Distributors and Covering them with Concrete.

Fig 8. Underdrains, Central Collectors and Sewage Sprinklers in Place.

upon in case the borough found it desirable to have other stone shipped in.

FINAL SEDIMENTATION BASIN.—The effluent from the sprinkling filters is to be subjected to a final sedimentation by passing through a basin having a capacity of about 160,000 gals., or nearly two hours' flow with the nominal capacity of the plant.

The basin is in excavation, with sloping sides, concrete floor, and is surrounded by a bank to protect it from floods. A dividing wall separates it into two distinct portions, so that one side can be drained for cleaning. Each side drains into a central manhole, the opening to which is controlled by a 10-in. sluice gate. From this manhole the deposited material will pass through a 10-in. vitrified pipe to the sludge well at the pumping station and from thence be pumped to the sludge disposal area. The effluent is drawn off at the lower end of the basin over a long weir. An 18-in. pipe then conveys this effluent to the outfall, which is protected by a concrete head wall and which is provided with a flap gate.

FIG. 9. TESTING SEWAGE SPRINKLER NOZZLES FOR PERCOLATING FILTERS, WASHINGTON, PA.

(The filters are but partly filled with filtering material. Wind is blowing across beds from left to right.)

COST OF PLANT.—The cost of the entire plant, exclusive of engineering, will amount to about $100,000, which may be approximately divided as follows:

Land	$14,000
Pumping station and machinery	12,500
Septic tanks	13,300
Filters	47,500
Final sedimentation basin	1,700
Water supply	3,000
Miscellaneous material	8,000
	$100,000

The principal unit prices and estimated quantities of the principal items are as follows:

	Quantity.	Unit price.
Excavation	7,500 cu. yds.	@ .28
Concrete, Class A	325 " "	11.00
Concrete, Class B	1,200 " "	7.40
Concrete, Class C	1,300 " "	6.00
Concrete, Class D	1,525 " "	7.00
Steel rods	30.5 tons	45.00
5-in. lateral collectors	61,000 lin. ft.	.05½
Cast-iron pipe	47 tons	50.00
Special castings, bell & spigot	5.5 "	85.00
Special castings, flanged	4.5 "	105.00
Cast-iron risers	425	2.25
Broken stone filter material	14,800 cu. yds.	1.20
Sewage pumping machinery,	lump sum	4,250.00

The contract was let in November, 1906, but work was not commenced until March, 1907. It is expected the plant will be in operation by September, 1908. The plant was designed by the writer, and is being built under his supervision, with Mr. Donald M. Belcher as resident engineer. Mr. O. K. Taylor, Jr., is the city engineer. The contractors are Williams, Proctor & Potts, Inc., New York City.

CONTRACTOR'S PLANT FOR THE SEWAGE PURIFICATION WORKS OF WASHINGTON, PA.*

By R. F. PROCTOR,† Assoc. M. Am. Soc. C. E.

The site chosen for the location of the sewage disposal plant for the borough of Washington, Pa. (see accompanying plan), is situated about three miles north of the borough and about 1,200 ft. from Arden Station, on a branch of the Pan-Handle Railroad. Between the railroad tracks and the site of the disposal plant are located the tracks of the Washington & Canonsburg Electric Railway. At Arden Station there is a siding which will hold eight cars. To build a siding from the main track to the disposal plant was found to be impossible, because the electric car company would not allow a grade crossing. It was also not feasible, as the cost of such a siding was not warranted by the size of the contract; therefore all materials received from the railroad have to be hauled to the site of the work.

The location of the plant was formerly the site of Standard Oil tanks. The septic tank is located on a knoll directly on one of these tank locations. The filters are located on the low land below, which is wet and marshy. The character of the soil below the loam is hard clay, and only in the excavation for the septic tank and the pipe line therefrom to the sludge bed has rock been encountered. The upper layers of this rock had been acted upon by the oil and were so rotten that they were taken out more easily with plow and scraper than the clay above them. Below this rotten rock is a hard sandstone.

As will be seen on the plan of the layout of the contractor's plant, on the northwestern side of the creek and about 1,000 ft. from the disposal plant, but on the borough farm, is a limestone quarry. The stone from this quarry has been carefully analyzed by the engineer and found to comply with the specifications.

Before the bid was submitted, the stone was seen to be outcropping and the stripping seemed to be small. Indications were favorable as to supply necessary to complete the work, amounting to about 20,000 cu. yds. of crushed stone, and the bid for the contract was based upon obtaining all necessary rock from this quarry. Experience in developing the quarry shows the quantity of stone to be more than ample and the stripping small, averaging about 1 ft. of stripping to 4 ft. face of rock.

Sand for the concrete is washed Ohio River sand, shipped in from Steubenville, O. Analysis of samples of this sand show it to have an effective size of 0.22 mm. and a uniformity coefficient of 2.1. The limestone dust from the crusher is mixed with the sand in the proportion of one to one for use in concrete. Analysis of this limestone dust show it to have an effecti ze of 0.09 mm. and a uniformity coefficien 13.6. Analysis of the combination of limes dust and sand mixed in equal parts gives a ective size of 0.15 mm. and a uniformity icient of 5.

Water for the boilers, gas engines, crete, etc., is obtained from a spring locate n the hill near the quarry, and flows by grav to all parts of the plant.

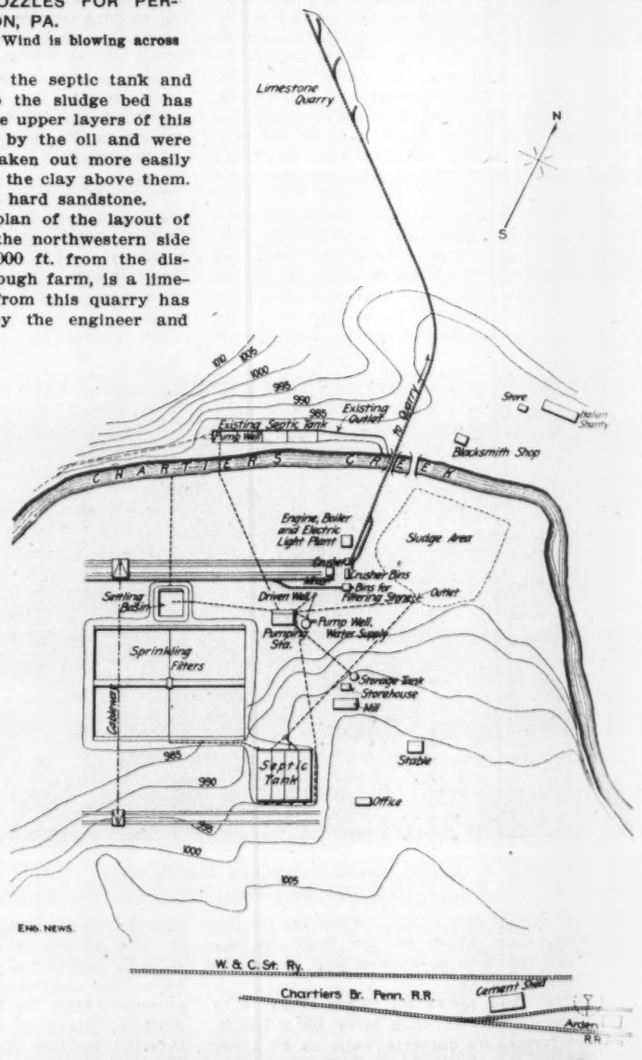
A cement shed with the capacity of ab 1,400 bbls. is located on the siding at Arden ation. So close is this shed to the railroad si that by laying a plank from the car to the r of the shed the bags of cement can be ea and quickly wheeled on small trucks into t shed. Each carload of cement is unloaded a piled by itself. Samples are taken from each and tested by the resident engineer in charg of the work, and a card nailed over the pile in the shed showing date of arrival, car numbe number of sacks and date of test.

All vitrified pipe is unloaded and piled on the ground near the cement shed. Sand is shoveled from the cars into a borrow pile by the side of the tracks. The vitrified pipe and sand are hauled by wagons as needed for the work.

Cast-iron pipe, rails and all other heavy materials are unloaded by a stiff-leg derrick and hauled directly to the plant.

The stone crusher, concrete mixer plant and storage bins are all located in a group at the lower end to one side of the disposal plant, with reference to the location of the cableway.

A service track of 2-ft. gage is laid from the quarry to the crusher. Over this track the



GENERAL PLAN OF SEWAGE PURIFICATION WORKS AND CONTRACTOR'S PLANT, WASHINGTON, PA.

*See preceding article on the same works by Mr. R. Winthrop Pratt.—Ed.

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stone is hauled by horse in Western dump cars, each having a capacity of 1½ cu. yds.

An Acme stone crusher, with a rated capacity of 2[illegible] cu. yds. of crushed stone per day of ten hours is used. This crusher is run by a 25-HP. Fairbanks portable engine and boiler. The crushed stone is raised by a bucket elevator to a screen over the stone bins.

The screen, which is of the revolving cylindric type, is divided into five sections, each section being 3 ft. long. The first section is perforated with ¼-in. holes, the second with ⅝-in. holes, the third with 1½-in. holes, the fourth with 3¼-in. holes and the fifth section with 4½-in. holes. The first section of the screen removes the dust and finest particles. The stone coming from the second, third and fourth sections of the screen is used as ballast for concrete. That coming from the fourth and fifth sections is used for filtering material. The tailings which come out of the end of the screen are used for ballasting the road or are recrushed.

At the bottom of the bins under this screen on both sides are shutes. Those shutes facing the concrete mixing plant lead to a bucket elevator, which raises the stone for concrete and sand to the bins over the mixer. The shutes on the opposite side carry the stone to a bucket elevator running up over two large storage bins and the stone for the filtering material is drawn from the bottom of these bins as needed. The dimensions of these bins are 10 × 10 × 16 ft. and 10 × 10 × 6 ft. This last-named elevator is run by the same boiler and engine which runs the crusher, crusher elevator and the screen, being connected to the gears of the screen by gears and sprocket chain.

The mixer plant consists of three superimposed platforms. The top platform carries four bins; one for sand, the remaining three for the three sizes of concrete ballast. Each of these bins is 7 × 8 × 8 ft. A bucket elevator raises the material to shutes by which any one of the four bins may be filled as desired. The bucket elevator is operated by a 8-HP. vertical steam engine, located upon the first platform. It is run by steam piped from the crusher boiler. This same engine drives an inclined belt, fitted with cleats, 5 ft. c. to c., by means of which the cloth bags of cement are raised to the second platform.

From the bottom of the sand and stone bins, and controlled by sliding gates, are shutes leading to the measuring hopper, located upon the second platform. This measuring hopper has a capacity of ¾-cu. yd., and is divided by wooden partitions into four boxes; one for sand and cement and the other three for the three sizes of stone ballast. Measuring sticks, which straddle the partitions and extend down into each box, indicate the level to which the box must be filled with sand or stone to make the proper proportioned mix.

The bottom of the measuring hopper is provided with a drop shutter. When the hopper is filled with the proper proportions of sand, stone and cement, this shutter is dropped and the contents of the hopper precipitated into the mixer. At the same time the proper amount of water is added to the mix through the snout of the mixer from a pipe leading from a barrel on the second platform. This barrel is filled by gravity from a storage tank on the hill near the quarry. On the inside of the barrel is nailed a scale, so that the quantity of water added to each batch of concrete may be accurately controlled.

A No. 2½ Smith concrete mixer is located on the first platform. It is operated by its own engine, the steam being supplied from the crusher boiler. This mixer has a capacity of ¾-cu. yd. per mix. A snout has been added to the dumping end, which extends out and over the buckets and cars which carry the concrete to the cableway.

A 3-ft. gage service track extends from the mixer plant and from under the filtering stone bins along the track of the head tower of the cableway. The flat cars which carry the filter stone and concrete to the cableway are hauled back and forth on this track by an endless cable, operated by a drum on the front of the cableway engine.

During the winter months the quarrying and placing of filter stone has been the chief work undertaken. Work in the quarry and at the crusher has proceeded day and night. A small electric lighting plant to furnish the necessary light for such night work was installed beside the crusher boiler. It consists of a 2¼-KW. generator, operated by a small vertical steam engine, steam for which is furnished from the crusher boiler.

A Lidgerwood cableway is used to place material. It has a span of approximately 500 ft. and a lifting capacity of five tons and can cover the septic tank, filters, sedimentation basin and pumping station. The towers are mounted on wheels and can be moved on tracks from one end of the plant to the other. On the front of the cableway engine is geared a drum, used to move the towers.

For placing concrete 1½-yd. Hains buckets are used. These buckets are circular in shape, the bottoms being drawn down to a truncated cone, with an opening of 22 ins. in diameter. This opening in the bottom of the bucket is covered with a steel door, divided into two sections, each section having a handle on one end and being hinged to the bucket at the other, so that when the door is closed by pulling the doors apart the bottom of the bucket is opened and the contents discharged. It is evident that the size of this opening can be controlled, thereby controlling the volume and rapidity of discharge. In placing the concrete the bucket is carried by the cableway over the form to be filled and discharged directly into it. Even distribution of the concrete is obtained by running the bucket out slowly, discharging it as it moves over the form.

These buckets are also used in placing stone. They have a decided advantage over the bucket of the tipping type in this particular work, as the filtering material is placed directly on vitrified sewer pipe underdrains, laid on the concrete floors of the filters, and the impact from the stone, which runs as large as 4 ins. in diameter, from a tipping bucket would break these tile. The Hains bucket can be lowered to within a few inches of the tile and the stone let out slowly and easily until the tile are covered sufficiently to protect them.

After the tile are covered the upper layers of stone are placed by the use of 2-yd. stone skips, built of 1¼-in. oak with a swinging door on one end. This skip is lowered into the filter, and the door and two of the lifting chains unfastened. The skip is then lifted out and emptied by the remaining lifting chain, fastened to the middle of the end of the skip opposite the door.

A sawmill was built, containing a tipping-table saw, band saw, lathe and grindstone, all operated by a gas engine. For all the walls, form sheets were made in the mill. These sheets are each 16 ft. long and made of ⅞-in. No. 4 tongued-and-grooved yellow pine lagging, 4 ins. wide, nailed to 2 × 6-in. studs, 20 ins. c. to c. Twenty-four of these sheets were made, six each 9 ft. high, 7 ft., 3 ft. 10 ins. and 2 ft. 10 ins. high. There are 48 special sheets, 16 ft. long, made in the same manner for the small distributor walls. The cableway is a great assistance in removing all the forms and resetting them. So far some of these forms have been used over as many as 15 times, with very little expense for repairing, and they will undoubtedly last throughout the entire job.

The faces of the wall sheets are oiled with a mixture of water white and petrolatum, mixed in about equal parts. As soon as the forms are struck, their surfaces are carefully cleaned with shovels and brooms and they are reoiled about every third time they are used.

The larger forms are all erected and braced from the ground against 4 × 4-in. walling pieces, spaced from 3 to 4 ft. apart. The forms are wired together with No. 6 wire. The small distributor forms are held together by ⅝-in. rods, threaded on both ends to take a nut screwed up against the outside of the form. When the forms are struck the rods are easily removed. The holes remaining in the concrete are filled during the process of finishing the surface of the concrete.

During warm weather the forms are usually taken down in from 18 to 24 hours after being filled and the exposed surfaces of the concrete are then finished. This finishing consists of wetting the surface of the green concrete and rubbing it with a wooden float, giving a pleasing, granular appearance. It has the advantage over the plaster finish in that it will not crack and scale off.

All concrete is mixed and placed very wet and is thoroughly spaded with flat spades having 12-ft. handles.

It is expected that the plant will be finished by Sept. 1, 1908. The contractors doing this work are Williams, Proctor & Potts, Inc., of New York City. Mr. G. R. Abbott is acting as superintendent. The plant was designed by Mr. R. Winthrop Pratt, of Columbus, O., and Mr. Donald M. Belcher is resident engineer.

THE CONVENTION OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

[Concluded from Engineering News of July 9, p. 44.]

PAPERS ON ELECTRIC-MACHINE DESIGN.

THE SPLIT-POLE CONVERTER.—The "split-pole converter," so called, is a type of synchronous converter, recently designed, in which the voltage ratio between the alternating-current input and the direct-current output is not fixed as in the old design, but may be controlled within certain wide limits by the operator. This is done in brief by splitting the field poles into two or three sections whose excitations may be separately controlled. The theory of the action of this machine has been a topic much discussed by designing electrical engineers. Prof. Comfort A. Adams, of Cambridge, Mass., in a paper entitled "Voltage Ratio in Synchronous Converters with Special Reference to the Split-Pole Converter" gave a mathematical analysis of the action of the new machine. He started with the conception that the e. m. f. curve of a single armature conductor would have the same shape as a curve showing the distribution of flux throughout the air gap traveled by the conductor. The resultant e. m. f. to be expected in an actual winding was determined by the vectorial addition of e. m. f. values from the curve for a single conductor or from the flux distribution. These proper values and the vector angles of their addition were determined by the pitch of the winding about the armature circumference. By varying the excitation in one section of the split pole a harmonic variation in the flux distribution may be superimposed upon the primary variation and therefore upon the e. m. f. curve of the single conductors. By a proper selection of the pitch of the winding these harmonics may be so added as to balance at the alternating-current taps, although their effect remains in changing the direct-current voltage. All this, with many other related ideas, was shown entirely mathematically by many formidable equations.

In the discussion, Mr. Paul M. Lincoln, of Pittsburg, said that while the value of such a paper was not to be minimized at all, he would like to call attention to the idea that e. m. f. wave form alone had been considered in the paper. The utility of such a machine depended on cost, efficiency, voltage regulation, floor space, noise, hunting, resonance action, etc., to a large degree, and that these characteristics would be brought out by use.

Dr. C. P. Steinmetz said that the action of the old synchronous converters with fixed voltage ratios were not entirely understood as yet, although the study of this new design was shedding some light on actions of the older types. The general conditions for securing a variable ratio between alternating-current input and direct-current output were then sketched without recourse to mathematics. To give Dr. Steinmetz's ideas very briefly, and therefore inadequately, it may be said that the direct-current voltage could be changed in several ways with

a constantly alternating e. m. f. impressed. It could be done by shifting the brushes around the commutator or by mechanically shifting the poles. Both of these actions, however, would be accompanied by heavy sparking at the brushes. The poles might be subdivided and by regulating their excitation the resultant effective poles could be shifted electrically. The same effect on the direct-current voltage can be produced by imposing on the fundamental e. m. f. wave of the winding an upper harmonic variation of e. m. f. by a variation in the magnetic flux of the air gap traversed. This flux variation is obtained by regulating sections of the split-poles. The split-pole converter, as built at present, acts in the last two ways named. It actually shifts, electrically, the position of its effective field and it also imposes a harmonic variation of voltage on the natural voltage in the windings.

STORAGE BATTERY REGULATION OF ALTERNATING-CURRENT SYSTEMS.—Mr. J. L. Woodbridge, Chief Engineer of the Electric Storage Battery Co., Philadelphia, classified the different alternating current systems where storage-battery regulation was useful as follows:

Generation Entirely Alternating-Current.
(1) Load wholly direct-current. Distribution by alternating-current transmission lines to direct-current substations.
(2) Load wholly alternating-current, polyphase.
(3) Load wholly alternating-current, single-phase.
Generation and Load Partly Alternating-Current and Partly Direct-Current.
(4) Direct-current fluctuations preponderating.
(5) Alternating-current fluctuations preponderating.

Mr. Woodbridge gave in considerable detail the ways in which it has been possible to use the storage battery as a reserve source of power for the alternating-current systems. Briefly, it may be stated that in each case the storage battery was charged by a rotary converter which, under heavy load on the alternating-current system, was driven by the storage battery and fed alternating current out onto the line. Mr. Woodbridge also showed how, in many instances, use of the split-pole converter, on account of the possibility of changing the direct-current voltage with a constant alternating-current voltage, brought some simplification of the apparatus. Three important pieces of auxiliary apparatus were described. The first of these, the carbon regulating rheostat, is in the field circuit of the booster or the converter, and is so operated by the alternating current that the fluctuations of the alternating-current load are relieved by the storage battery. The second piece of apparatus was the split-pole converter itself, the action of which was shown with the aid of diagrams. The third auxiliary described was a special exciter for varying the field of a booster or split-pole converter. In this machine a bipolar armature revolves in a four-pole field frame which, however, is so wound as to be magnetically bipolar. The armature carries both armature and collector rings. The collector rings are connected to the three-phase line (through transformers). One pair of brushes (those between the two north and two south poles respectively) tap off current for the field of the booster or converter in series with a winding on the fields. The alternating-current connection of the armature would allow a rotating field in it, but as the armature is driven in reverse direction by a synchronous motor this field is stationary. The reaction of the three fields so regulates the exciter voltage and the current in the booster (or converter) field that the machine is very sensitive to slight changes in the alternating-current load. The machine may be used to regulate power factor and to respond to any particular phase component of the alternating current.

A 6,500-KW. GENERATOR.—Mr. B. A. Behrend, Chief Electrical Engineer, Allis-Chalmers Co., Milwaukee, Wis., presented a descriptive paper on a new generator built for the Niagara Falls Hydraulic Power and Manufacturing Co. This machine is wound three-phase current at 12,000 volts and 25 cycles. It is to be driven at 300 r. p. m. by an 11,000-HP. horizontal waterwheel. The continuous overload capacity is approximately 7,500 KW. A runaway speed of 506 r. p. m. had to be provided against. Several views of the constructions used were exhibited and a complete assembly drawing was appended.

The middle part of the rotor, carrying the fields, is a solid nickel-steel disk without a hole in the center. Therefore the shaft is not continuous and the halves are bolted to the disk. This nickel steel has an ultimate strength of 80,000 lbs. per sq. in. and an elastic limit of 50,000 lbs. The magnetic qualities are very close to those of standard sheet steel. The stator weighs 116,700 lbs., the rotor 92,900 lbs. and the entire machine 275,000 lbs. The full load efficiency under test was 97.7% at 90% power factor. The regulation was within 8.4% at 12,000 volts, with 100% power factor, full load.

DEVELOPMENT OF SINGLE-PHASE GENERATORS.—A comparison of the old types of small, high-frequency, single-phase alternators, with small pole pitch and weak armature reaction, to the modern, large, low-frequency, single-phase machines was made by Mr. W. L. Waters, of Pittsburg. It was brought out that the present troubles in designing were due largely to the large pole-pitch necessary, to the resultant mechanical stresses on the long end connections of the armature coils and to the strong pulsating armature reaction unavoidable.

The stresses in the long end connections were carried by heavy bronze braces, holding the coils down.

The effect of the armature current in the single-phase alternators is to produce pulsating cross and back-magnetizing flux through which the field magnets rotate with excessive loss in the iron due to hysteresis and eddy currents. Tests of the actual value of these losses are difficult and only approximate values can be obtained. The use of heavy copper dampers on the pole faces allows heavy currents to circulate, at small loss, and to produce a field that neutralizes the pulsating flux. Tests were reported on two two-pole, 25-cycle, 1,000-KW., single-phase machines with and without pole-face dampers. Without the dampers the losses were 3.0 and 3.8% of the rating and the temperature rise was 122° and 150° C. respectively. With proper dampers in place these figures became 0.5%, 0.3%; 37° and 18° C., respectively. On these grounds it was contended that the design of single-phase generators for 15 and 25 cycles, in units of 5,000 to 10,000-KW. capacity, was as successful as for standard slow-speed polyphase machines.

In the discussion of Mr. Waters' paper Dr. C. P. Steinmetz outlined a method of loading a three-phase generator with a single-phase power circuit so that the currents in the three phases of the generator were properly balanced. The generator is to have its armature star-connected with two leads supplying the single-phase circuit. A heavy reactance coil is connected between the remaining lead and one of the single-phase connections. Energy is stored in the reactance coil during one-half cycle and returned during the next half cycle, so that the engine torque is constant. This characteristic, it was claimed, would be valuable for low frequency alternators—10 or 15 cycles, if ever built.

ELECTRIC TRACTION PAPERS.

FROM STEAM TO ELECTRICITY ON A SINGLE TRACK ROAD.—Mr. J. B. Whitehead, of Baltimore, presented a study of the problems solved in the conversion of the Annapolis Short Line, a 25-mile, standard-gage single track line with a long steam history. This was held to be typical of a class of roads, intermediate between the interurban and the trunk line, which when electrically operated should yield some indication of results to be expected with the heaviest projects. It was admitted that the change on the road in question was not made in expectation of greatly increased economy of operation. The change was made to secure increased car mileage, more frequent local service, fast, clean express service as well as the popular and sentimental attraction accompanying electric traction. To meet present needs it was proposed to run single-car trains every half-hour in the busy periods and every hour at other times, with locals and expresses alternating. The power was to be purchased. The study of what electrical system to install narrowed down to the 25-cycle single-phase alternating-current system and to the 600-volt direct-current. The basic comparisons were made on first cost and operating expenses. Some of the studies are summarized in what follows.

Power Distribution.—Data on existing installations show a wide difference in the rail-joint resistances allowed. In various cases this is 5%, 10%, 15% greater than continuous rail. After a study of all the data available the attainable resistance values with 12-in. welds were taken as: bonded to 17% equivalent to copper, 15% over continuous rail; bonded to 14% equivalent to copper, 10% over continuous rail; bonded to full equivalent, 5% over.

Equally variant assumptions were found generally employed for the value of drop in rails and trolley on alternating-current circuits. The author presented a theoretical study of the circuit and, applying certain local conditions, deduced the voltage drop per 100 amperes at 25 cycles in No. 000 single catenary trolley, 22 ft. above a track of 80-lb. rails as between 65 and 70 volts.

Train Resistance.—A great diversity of data on train resistance was also found. It was held that, during the acceleration period, train resistance wasted only a slight proportion of the tractive effort and that errors in values selected were of no great importance. On this project Blood's well-known formula was used for speeds of 20 mi. per hr. and over and 100 lbs. per ton tractive effort was assumed necessary for an acceleration of 1 mi. per hr. per sec.

Comparison of Systems.—Proper motor capacity for each system was first determined for 75, 100 and 125-HP., four-motor equipments by a study of typical speed-time, current-time and power-time curves. After suitable motor equipment for each system was selected

speed-time, current-time, and power-time curves for each type of equipment were then plotted for every local run in each direction, due account being taken of curvature, grades, limited speed on bridges, etc. The value of this rather tedious process has been questioned. In the present case it not only afforded by comparison an indication as to the value of the typical curves for the purpose of computing an entire project, but it also enabled a run sheet to be constructed which developed passing points at rather different places than would have been indicated by the usual straight lines of schedule speed. The latter point is of particular value in a single track problem as determining which sidings should be equipped with trolley. After fixing the regular schedule sidings, a drop-back siding was provided in each case so as to prevent a loss of time being communicated to opposite traffic. This resulted in the fixing of eleven sidings, one of which is one mile long and another a half mile long, and there are three miles of double track at the Baltimore end. The total length of track thus becomes about 33 miles.

As a result of working out the complete series of curves for a 37-ton direct-current and a 42-ton single-phase car it appears that the average power required per car mile, direct-current system, for a complete run is 3.2% greater than the typical curves, while for the single-phase car the increase is 3.5%. The typical run seems then to agree closely with the average of the complete set. This is to be noted as the road is neither very straight nor very level. The average values for power required finally accepted were: for 45-ton d. c.-car, 3.43 KW.-hr. per car mile at the car and for the 50-ton a. c.-car, 3.32 KW.-hr.

Station Equipment.—For the alternating-current system with motor-generators on purchased power the study of the power-consumption worked out to be 4,350 KW.-hr. daily consumption under normal schedule. With direct current from rotary converters the power figures above quoted works to be 4,200 KW.-hr.

Choice of System.—The choice was made on a comparison of first costs and operating expenses. The power consumptions were previously shown about equal. Substation attendants cost $5,400 per year more with the direct-current. Cost of maintenance were not deeply analyzed in the paper, but stated at $5,565, in favor of single-phase equipment. The first cost of the direct-current and single-phase constructions were given as $397,300 and $344,300, respectively. The entire annual benefit through using the alternating-current instead of direct

was figured out as $8,865. The single-phase was accepted.

In the discussion of this study Mr. W. I. Slichter, of Schenectady, said there was some disadvantage in the single-phase system in not having the rotary converters to fall back on. He claimed that it was generally conceded that for 25 cycles and 80% power factor there was eight times the direct-current impedence. The drop per ampere of the whole system was often considered twice the direct-current value. On starting there was only 50% increase over running drop.

Mr. C. F. Scott presented a discussion by Mr. A. W. Copley, of Mt. Vernon, N. Y., in which results were given of tests made on the New York, New Haven and Hartford R. R. These gave the total impedence drop, for 25 cycles, as 19 volts per 100 amperes per mile, and for 10 cycles at 20 volts. The "resistance" of 80-lb. rails with alternating current at 25 cycles was 0.16 ohm per mile. It had been found that 70% of the current leaving the car windings started back along the track and that 30% left in the other direction. In two miles this 30% had all leaked out. The 70% had decreased to 40% near the power-house.

Mr. A. H. Babcock, of San Francisco, held that the method of determining the most suitable system as outlined could not be the only one. On the mountain division of the Southern Pacific R. R. both single-phase and direct-current systems gave the same estimates for cost and the same for operating expenses.

INDUCTION MOTORS FOR MULTI-SPEED SERVICE.—Mr. H. C. Specht, of Pittsburg, presented analytical study of the performance of two induction motors of a cascade set connected in direct and differential concatenation. These motors would have their rotors mounted on the same shaft. The primary of the first motor would be connected to the alternating-current line and its secondary would be connected to the primary winding of the second motor. The secondary of this motor finally is short circuited through a greater or less resistance. If the motors tend to start in the same direction they are said to be in direct concatenation, and if they tend to start in opposite ways they are connected differentially. Differential concatenation results from reversing one phase connection between the secondary of the first motor and the secondary of the other. The author compared his theoretical discussions with results from tests; with two 60-cycle motors, one having ten poles and the other eight the following synchronous speeds were obtained:

(1) Motor I. and II. in direct concatenation; 450 r. p. m.
(2) Motor I. single; 720 r. p. m.
(3) Motor II. single; 1,200 r. p. m.
(4) Motor I. and II. in differential concatenation; 1,800 r. p. m.

The change from one speed to another could be made without mechanical disturbance by changing the electrical connections through high resistances. The disadvantages of the cascade sets are their low power factor and efficiency compared with single motors. The advantages claimed lie in a flexible and simple speed control and a safer operation.

In the discussion, Mr. W. I. Slichter, of Schenectady, said that for railway work when two motors were connected cascade the torque of the unit would always be less than the sum of the torques of the motors used alone.

THE ECONOMIC LOCATION OF SUBSTATIONS FOR ELECTRIC RAILWAYS.—Mr. G. B. Werner, of the Railway Electric Power Co., New York City, presented a mathematical analysis of the economic features of the various annual charges of an electric road as functions of a single variable—the number of substations Algebraic expressions were deduced for

(1) Annual charges on substations.
(2) Annual charges on overhead copper.
(3) Annual cost of substation losses.
(4) Annual cost of secondary conductor losses.

By trial or graphically the number of substations and the economic distance between them for the minimum value of the charges, particular and combined, may be obtained.

In the discussion of this paper the opinion was generally expressed that the use of such expressions could not take the place of personal experience, and that substations would be placed where simpler studies, based on previous work, dictated. It was admitted generally that such expressions might fairly well serve the younger engineers who had not great experience to fall back to.

CONDUCTOR RAIL MEASUREMENTS.—The paper of Mr. S. B. Fortenbaugh dealt with some peculiar phenomena noted on the lines of the Underground Electric Railways Co., of London, England. The power supply for the trains on these lines is carried by insulated third and fourth rails independent of the running rails. In brief it may be said that many tests had shown that with 600 volts between third and fourth rails the potentials to earth were of the order of 550 for the positive and 50 for the negative, instead of 300 and 300 as might have been expected. This phenomenon was noted even after the polarity of the rails was changed, the statement applying always to that rail acting as the negative. The author expressed the belief that the action might be primarily similar to the well-known fact that a negatively charged (static) conductor leaks away its charge quicker than does a positive. It would then be expected that the negative rail conductor might ionize the air slightly and slowly increase the conductivity of the surrounding gas as well as assist in the deposition of moisture. The author's conclusions are appended.

(1) The difference of potential between the positive conductor and earth is always normally considerably greater than the potential existing between the negative conductor and earth. (2) This difference between the positive and negative insulation becomes more marked the longer the conductors are subjected continuously to a difference of potential in the same direction. (3) A reversal of the polarity is always instantly accompanied by a considerable increase in the normal leakage current between the positive and negative conductor. (4) The above phenomena can be repeated indefinitely and are independent of the length of time that the pressure has been previously applied to the conductors in either direction. (5) The insulation of the negative conductor to earth cannot be proportionately maintained.

POWER PLANT PAPERS.

DOUBLE-DECK STEAM-TURBINE PLANTS.—An example of this comparatively new type of steam-power plants was described by Mr. J. R. Bibbins, of Pittsburg. This plant, located at West Point, Ind., serves several interurban railway lines. A few brief comparisons were made in the paper to a larger double-deck plant at Fort Wayne. The paper is summarized in another part of this issue.

GAS-DRIVEN POWER PLANT.—The author of the preceding paper presented the results of a 30-day test on the plant of the American Locomotive Co., at Richmond, Va. This is a 300-KW. plant with a horizontal, tandem, gas engine, operating on producer gas from a part engine, operating on producer gas from a pair 15,000-cu. ft. holder. Throughout the plant, the construction is of the latest type. The results of the test are summarized in the accompanying table.

GENERAL RESULTS OF TEST, RICHMOND GAS POWER PLANT.

	Full load.	Three-quarters load.	Half load.
Length of run hours	223	125	136
Average load, KW	312.3	228.3	159.6
Load, per cent. engine rating	91.0	67.6	47.5
Load, per cent. generator rating	104.0	77.2	53.2
Coal gasified per hr.	517.0	433.0	351.0
Lbs. coal per KW.-hr.	1.654	1.697	2.20
Lbs. coal per KW.-hr., guaranteed	1.93	2.10	2.64
Avg. heat value of coal, B. T. U.	14,392	14,392	14,392
B. T. U. per KW.-hr.	23,700	27,280	31,650
Per cent. thermal efficiency, brake	15.51	13.6	11.75
Per. cent. thermal efficiency, elec.	14.35	12.65	10.78

Coal.—Pocahontas Run-of-Mine; avg. heat value, dry sample, 14,708, as fired, 14,392; volatile matter, 22.8%, ash 4.5%, sulphur 1%.
Test.—August 12, 7 a. m., to September 7, 12 m.

As the works were not operated Sundays there were several days during which the plant was idle. The producer fires were kept at normal level in good condition. The producer operator estimated that an average of 1,700 lbs. of coal was required to compensate for standby losses from 6 p. m. Saturday to 7 a. m. Monday—37 hours. This is a low rate for such losses, being 46 lbs. per hr., or 2.5% of weekly coal consumption.

HYDRO-ELECTRIC SYSTEM OF THE SOUTHERN POWER CO.—Mr. J. W. Fraser, of Charlotte, N. C., presented an analysis of some engineering features of the system of the Southern Power Co., under construction at various points along the Catawba River. These had to do mainly with the reasons for selecting certain voltages, frequency and types of construction. A summary of this paper was printed in Engineering News, July 9, in connection with the high-tension transmission papers of this convention.

MISCELLANEOUS PAPERS.

THE GENERAL EQUATIONS OF THE ELECTRIC CIRCUIT.—Dr. C. P. Steinmetz presented a paper which was readily acknowledged as a classic too deep for the ready comprehension of all the engineers present at the convention. This was to be expected after Dr. Steinmetz explained that he had been working on the investigation for two years and that it was still incomplete. As an abstract of the paper, the problem solved was outlined in general terms.

Ohm's law expressed for alternating currents has formerly been taken as the most general expression for the relations between voltage, current and impedence. Lightning and other transient effects have necessarily been unaccounted for. Dr. Steinmetz has built up his equations for the whole electric circuits in terms that account for the voltages and currents in various parts of the circuit under direct or alternating current, lightning discharges, oscillatory surges and all transient electric phenomena. The only condition imposed in the study was that the natural constants of the circuit (resistance, inductance, conductance and capacity) remain constant for all values of time and distance.

It is impossible to present here the long mathematical deductions and a complete physical concept of the expressions was not given. This, it was stated, was reserved until the completion of the work. The whole study was essentially one of wave actions.

There was little technical discussion on this paper, the comments being almost wholly laudatory. As one engineer expressed it, "this study might well be presented here and be discussed two years hence," or as another said, "the paper must be studied and discussed by the coming generation."

AN EASY METHOD FOR THE SOLUTION OF ALTERNATING CURRENT PROBLEMS.—Mr. Harold Pender, of New York City, in this paper simplified the formulas for use in many alternating-current problems where the long calculations arise from complex formulas for impedence and admittance. It will be remembered that Ohm's law expresses the relations between current (I), voltage (V) and impedence (Z) as:

$$Z = \frac{E}{I}.$$

The impedence is made up of simple resistance (R) and magnetic reactance (X), by:

$$Z = \sqrt{R^2 + X^2}.$$

Where parallel parts of circuits are involved, impedence, resistance and reactance are not directly additive as are the reciprocal functions admittance, conductance and susceptance. Necessarily the use of reciprocal functions is more directly applied. The simplification proposed by Mr. Pender is based on the employment of a reactance factor ($T = X/R$), of the ratio of resistance to impedence (R/X), of a power factor ($K = R/Z$). The relations of Z, X and R are evidently those of the hypotenuse and legs of a right-angle triangle. The author worked out the application of these simple relations to minimizing computations in simple circuits, transmission lines, transformers, transformers on transmission lines, induction motors, etc.

In opening the discussion of this paper, Prof. Comfort A. Adams said that any work saved in an actual computation through this method was more because of an excellent tabulation than by mere short algebraic work. From the teachers' standpoint these short cuts, even if effective and time-saving for repeated or routine work, were disliked for the average man

in that they did not enforce their accompanying physical concept.

PRIMARY STANDARD OF LIGHT.—Among the divers problems approached by Dr. C. P. Steinmetz, is that of a primary standard of light. In this paper it was proposed to combine on a photometric screen three monochromatic lights; a green, a blue and a red, from two ordinary mercury-vapor lamps and from one quartz-tube, high-temperature, mercury lamp, respectively. The selection of the proper wave lengths would be, by spectroscopic prisms, from equidistant points along the visible spectrum. The intensity of light flux would be measured separately before being combined on the screen and the accuracy of the determination would be limited only by that of the measurement of energy radiation. It would not be necessary that the intensity of the lamps should be exactly reproducible, as their relative intensities could be varied as desired and accurately determined by physical measurement

Dr. C. H. Sharp, of the Electrical Test Laboratories, New York City, in the discussion, said that the standard proposed might prove a possible or probable solution of the problem of a suitable primary standard. Before the time of electric lighting, flame standards were accurate enough, he said, if their variation was less than the variation of the commercial lamp. The later necessity for a better standard had led to Violle's fused platinum standard which, while widely adopted, had not been found accurately reproducible. The speaker expressed some doubt as to whether the physiological effect of a mixture of three monochromatic lights would be the same as light from a length of continuous spectrum—a polychromatic light.

Dr. E. B. Rosa, of the National Bureau of Standards, Washington, D. C., said that if a serious attempt were made to develop this standard, enough valuable experience would result to reward the trouble even if the standard was not a success. Such a work as the study of this standard was held to be clearly a work for which the Bureau of Standards was well equipped.

Prof. H. S. Carhart, University of Michigan, said that the selection of three groups of wave lengths might be traced to the presence, in persons, of three distinct primary color sensations. The relative energy in three wave lengths should be determined with comparative ease, although the full realization of the standard needed much time.

Dr. Steinmetz in closing the discussion said that he had selected three points on the spectrum for maximum accuracy in determination. These were all as far as possible from the outside of the visible spectrum where the retinal-energy coefficient would be a minimum. The convention passed resolutions instructing the Board of Directors to ask that the practicability of the Steinmetz primary standard be investigated by the Bureau of Standards.

THE ELECTRIC HEATING PLANT AT BILTMORE ESTATE.—Mr. C. E. Waddell, of Biltmore, N. C., presented a short descriptive paper on the electric-heating plant in the Vanderbilt "Biltmore House." It does not appear from the paper that the heating of the great house itself is by electricity. The apparatus described provides the supply of hot water for the whole house and the steam for the laundry, besides heating a dry room and some ironing apparatus.

The hot-water supply is, through an ordinary loop system of piping, from

the electric heater, a cylindrical steel tank, 3 ft. in diameter by 5 ft. long, containing 20 flues arranged in two concentric circles, and the whole closely resembling in appearance a miniature horizontal tubular boiler. Each of the 20 flues contains a heating element of 5 KW. capacity; consequently the total capacity of the heater is 100 KW. The connecting terminals are brought out at one end of the tubes; at the other end a nut holds the elements in place. The withdrawal of the element is accomplished by simply removing the nut. The electric heater is installed beside the coal heater and the two are provided with valves so that either or both may be used as occasion demands. Electricity is supplied in the form of a three-phase, 60-cycle, alternating current at 230 volts. A switchboard panel is installed immediately in front of the heater and the elements are grouped thereon in three banks, each bank connected to phase, a feature of great value in balancing the load on the transformers. The power-factor of the elements is unity.

The cost of the fuel heater installed complete was about $350. The cost of the electric heater, installed complete, including switchboard, foundations and pipe connections, was approximately $1,200.

To provide the necessary steam for the laundering, a flash boiler was used which

consists of a group of five 3-in. vertical pipes. Around the pipes the heating elements are placed. The pipes are interconnected at both top and bottom; the top is provided with a steam dome; and the whole is equipped with water column, steam gage, pop valve and inlet water regulator. The function of the regulator is to keep the water level in the boiler constant. Feed water is taken from the hot water mains. At the base, and integral with the frame, are five switches, each controlling a 7-KW. element.

Steam at practically zero pressure is conducted to five tubs and there discharged through perforated pipes located in the bottoms. The tubs are made of porcelain and contain about 2 cu. ft. each.

When new the generator was tested to determine its evaporative efficiency; this was found to be between 95 and 100%.

The dry room, of 640 cu. ft. contents, had three heating plates. When the electrical heaters were installed an 18-in. ventilation duct was run to a nearby chimney. Only enough heat was required to maintain an active circulation. The average performance of the dry room for a general wash was:

Water expelled, lbs. per KW.-hr.	0.68
Fabric dried, lbs. per KW.-hr.	0.83
Number pieces dried per KW.-hr.	2.73

The mangles and similar pieces of apparatus were changed from steam to electric heat by the insertion of heating units in the rolls.

A PORTABLE STROBOSCOPIC FORK.—Messrs. A. E. Kenelly and S. E. Whiting, of Cambridge, Mass., called attention to a portable arrangement of the well known "stroboscopic fork." The apparatus consists essentially of an electrically operated tuning fork provided with slotted shutters and a slider for changing the frequency of vibration. By placing a peculiarly spaced target on any shaft, the speed of rotations may be measured, by peeping through the vibrating shutter and observing that part of the target which is stationary or apparently revolving so slowly that the apparent speed can be accurately counted. The actual speed of the target is then determined, from the known frequency of vibration of the fork, with an error of less than 1 part in 1,800.

TECHNICAL EDUCATION.—Papers on the relation of the manufacturing concern to the student were given by Mr. M. W. Alexander, of the General Electric Co., Lynn, Mass., Mr. D. B. Rushmore, of the General Electric Co., Schenectady, and Mr. B. A. Behrend, of the Allis-Chalmers Co., Milwaukee. These papers and the long but interesting discussion will be summarized in a later issue.

CONSERVATION OF NATURAL RESOURCES.—As the convention was about to adjourn, Mr. J. H. Finney, of Atlanta, Ga., urged every section manager, director and influential member to go home and talk national conservation of resources. It was said that in this way only could the work of the states, in connection with the Conservation Commission, be effectively advanced. The engineers should lead the movement and not merely trail behind, and then "no Speaker could excuse congressional failure to pass an Appalachian Forest Bill with the statement that in all the engineers' claims there was but one grain of wheat to a bushel of chaff."

Several papers presented during the different sessions can be mentioned in this report by title only. Among such are:

"Critical Study of Lightning Records on Taylor's Falls Transmission Line," by P. H. Thomas, New York City.

"Three-Phase Power Factor," by A. H. [illegible].

"Fractional Pitch Windings for Alternating Current Generators," by J. Bache-Wiig.

"The Proportions of Copper and Iron in the Design of Alternators," by C. J. Fechheimer.

"Graphical Treatment of the Rotating Field," by R. E. Hellmund.

A MACHINE FOR HANDLING COKE IN STORAGE.

As coke is very friable, the use of a grab bucket, steam shovel or similar apparatus is commonly avoided in storage yards. It is essential that the coke should be placed in the furnaces in large pieces, and the devices named cause excessive breakage. The machine shown in Fig. 1 is a distinct departure from the ordinary storage-coal and coke-handling machinery, and moves the fuel much more gently. This arrangement is a development of the mine-car loader described and illustrated in Engineering News, October 31, 1907. To begin with, the scraper-conveyor is much larger, and the delivering-conveyor arm is extended and supported from a latticed tower. The scraper-conveyor, moving slowly at 80 ft. per min., takes the coke from the base of the pile without great breakage. The fuel is screened at the outer end of the delivering-conveyor. The machine is electrically operated, power being supplied through a flexible connection which runs to a convenient contact post.

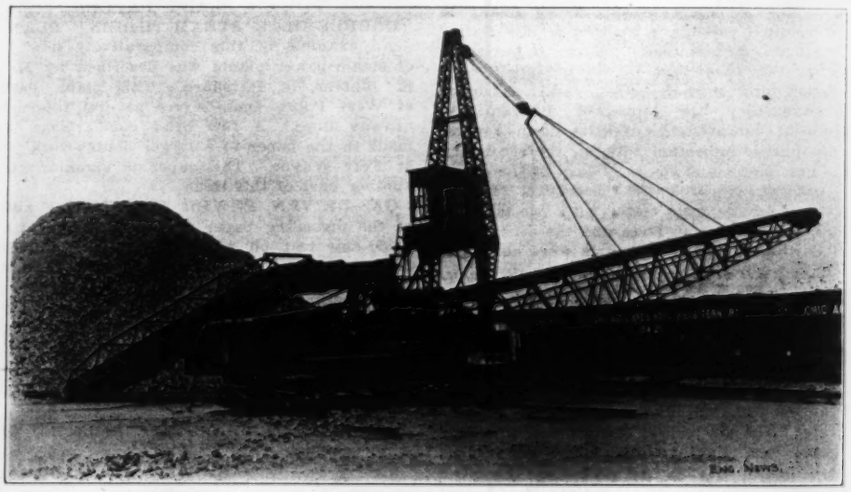


FIG. 1. A COKE-HANDLING MACHINE AT THE STORAGE YARD OF THE ILLINOIS STEEL CO., STOCKTON, IND.

(Designed by Mr. W. E. Hamilton and Manufactured by The Hamilton Manufacturing Co., Columbus, Ohio.)

Fig. 1 shows the machine at one end of a coke storage yard at Stockton, Indiana. It may be pertinent to note here that Stockton is the name given to the general storage yard of the Illinois Steel Co.'s plants and is midway between Gary and Buffington, Indiana, on the Chicago, Lake Shore and Eastern Ry. There is no town at Stockton, and the nearest railway station is at Pine. As the machine is shown in Fig. 1, coke is being loaded from a strip about 100 ft. wide into cars on a siding. An idea of the size of the coke storage yard is gained from Fig. 2, which shows some 100,000 tons in a pile a half mile long. Fig. 3 gives a general layout of the yard.

The coke is delivered into and out of storage in better condition than with grab-bucket or even good hand loading, and a saving of some 5% in breeze loss is estimated by the makers and users in handling the coke from oven to furnace. In unloading for storage, the coke is dumped onto a platform from hopper-bottom cars on the trestle shown in Fig. 3. The nose of the machine is swung underneath the trestle and the delivering-conveyor lands the coke at

FIG. 2. COKE STORAGE PILE OF THE ILLINOIS STEEL CO., NEAR GARY, INDIANA.

the apex of the pile, or where desired, which may be up to 40 ft. above ground level. It has been common practice in many places in putting coke into storage to empty a train load of side-dump cars on the yard, to level with an ordinary grader's spreader over the track, to jack up the track, using coke as ballast, and then to repeat the whole operation, extending the base of the pile and increasing the height until the track grade prohibited further storage. It is reported that such treatment results in less breeze than when grab buckets and cranes are used. There is an added value in having screen coke delivered to the cars, as is done with this machine. This lies in not having fine dust blowing out of the furnace with the blast.

Among the other advantages claimed is the low investment for a given handling and storage capacity. When additional storage capacity is demanded it is merely necessary to extend the tracks and trestle.

The machine is the invention of Mr. W. E. Hamilton, and is manufactured by the Hamilton Manufacturing Co., Columbus, Ohio. The accompanying table shows the machine in operation at Stockton.

DAILY REPORT OF COKE LOADED AT STOCKTON.
Hamilton Loading Machine, April 27, 1908.

Railway cars.	Received.	Loaded.	Minutes loading.	Net weight.
1	8.05	8.18	13	60,620
2	8.19	8.28	9	59,620
3	8.31	8.43	12	60,940
4	8.45	9.00	15	62,380
5	9.03	9.13	10	59,640
6	9.15	9.25	10	58,340
7	9.27	9.38	11	59,730
8	9.39	9.54	15	58,740
9	9.56	10.08	12	56,230
10	11.04	11.16	12	60,460
11	11.20	11.31	11	61,500
12	11.34	11.46	12	61,120
13	11.48	12.00	12	60,800
14	12.54	1.06	12	62,240
15	1.08	1.20	12	62,300
16	1.24	1.35	11	66,500
17	1.38	1.49	11	64,710
18	1.51	2.05	14	53,380
19	2.07	2.18	11	63,520
20	2.20	2.31	11	59,720
21	2.41	2.55	14	61,920
22	2.59	3.10	11	67,100
23	3.12	3.24	12	61,900
24	3.28	3.43	15	60,700
Total			288	1,464,100

WORK PERFORMED.

Number of cars loaded	24
Number of tons loaded	732
Average tons per hour	152.5

COST OF LABOR.	Rate.	Amount.
Operator, 1	$3.50	$3.50
Helper, 2	1.75	3.50
Total		$7.00

Running time of machine, 288 min., or 4 hrs. 48 min.
Average tons per car, 30.5.
Average tons per min, 2.5.
Best car, 66,500 lbs. in 11 min. = 3 tons coke per min; = 5 tons coal per min.
Note: Weights given are of screened coke.

A STEAM MOTOR CAR: CHICAGO, ROCK ISLAND & PACIFIC R. R.

A 250-HP., oil-burning, compound, steam motor car was recently completed at the Schenectady works of the American Locomotive Co., for the Chicago, Rock Island & Pacific R.R. The general appearance of the assembled car is shown by Fig. 4. The car body is of steel construction throughout, with the exception of the interior finish; and is divided into three compartments; an engine room, baggage room and passenger compartment, the latter having a seating capacity of 40. This last compartment also includes toilet facilities. On test runs made on the experimental tracks of the New York Central R.R. the car has shown its capability for high speed. On several of the runs speeds of 60 mi. per hr. have been attained.

In the design of the car body, built by the American Car and Foundry Co., the aim was to make it as light as possible consistent with great strength. With this object in view, therefore, a truss-rod construction was employed instead of following the more usual practice in the construction of steel cars of making the side frames below the window plates in the form of a girder or truss of sufficient strength to carry the whole weight of the car. The side posts are rolled steel angles riveted at the bottom to the side sills and at the top to the side plate angles, which extend in one continuous piece the entire length of the car on each side, and are bent at the ends to the shape of the end of the car. The carlines are steel channels bent to conform to the contour of the round roof. The side sills consist of 6 × 4 × ½-in. steel angles reinforced by 1½-in. truss rods and the center sills are 8-in. I-beams. For a distance of 20 ft. back from the front end, the side sills are reinforced by 6 × 4 × ½-in. angles, riveted to the sills in such a manner that the horizontal leg is uppermost, furnishing a bearing surface for the floor of the engine room. The end sills are 8-in. steel channels securely fastened to the side sills by means of wrought-iron corner plates and to the center sills by angle connections. A number of steel angles, fastened to the side sills and center sills by angle connections, tie the center and side sills together between the bolsters. These cross braces also serve as supports for the floor.

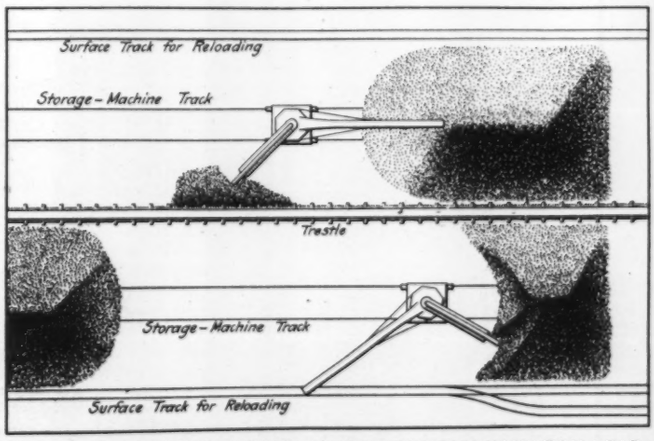


FIG. 3. COKE STORAGE-YARD LAYOUT FOR THE HAMILTON LOADING MACHINE, ILLINOIS STEEL CO., STOCKTON, IND.

DIMENSIONS OF STEAM MOTOR CAR: CHICAGO, ROCK ISLAND & PACIFIC R. R.

Total weight	100,000 lbs.
Weight on leading truck	61,700 "
Weight on drivers	32,400 "
Weight on leading wheels	29,300 "
Weight on rear truck	38,300 "
Total wheel base	45 ft. 10 ins.
Distance between truck centers	38 ft. 3 ins.
Wheel base of driving truck	8 ft. 4 ins.
Length of car body over sheathing	52 ft.
Length of car body over platform	55 ft. 9 ins.
Diameter of cylinders, High pressure	9¼ ins.
Diameter of cylinders, Low pressure	14½ ins.
Stroke	12 ins.
Valves	Piston
Valve gear	Walschaert
Wheels.	
Driving, number	2
Driving, diameter	38 ins.
Leading, diameter	33 ins.
Rear truck, diameter	34 ins.
Journals, driving	6 × 12 ins.
Journals, trailing truck	4¼ × 8 ins.
Boiler.	
Type	Horizontal, return-tubular.
Working pressure	250 lbs. per sq. in.
Outside diameter at intermediate smoke-box end	44 ins.
Fire-box, length	33⅛ ins.
Fire-box, width	43¼ ins.
Tubes, diameter	1½ ins.
Tubes, number and length	214-3 ft. 9 ins.; 214-3 ft. 11½ ins.
Heating surface, tubes	527.8 sq. ft.
Heating surface, fire-box	37.6 sq. ft.
Heating surface, super heater	59 sq. ft.
Heating surface, total	624.4 sq. ft.

The bolster at the trailer end of the car is of the built-up type, while that at the motor end is of cast steel, made in three sections so that the middle section may be readily removed to permit of the boiler and engine being drawn out from the end of the car. The middle section of the front end framing of the car body and the flooring ahead of the engine are also made removable for this same purpose.

The floors of the passenger and baggage compartments consist of two layers of wood, the upper layer being laid diagonally across the car; while the floor of the engine room is of steel with wood covering; the section ahead of the engine between the center sills being, as aforementioned, removable. The inside sheathing of the passenger and baggage compartments is of mahogany and the head lining is fireproofed board. The car is lighted by oil lamps hung from the center of the car, there being four pairs in the passenger compartment and one pair in the baggage room.

The car is equipped with spring buffer and M. C. B., single-spring draft rigging, with a Major passenger coupler at the trailer end and with a tender coupler at the motor end.

In the design of the boiler the problem of providing the required amount of heating surface within the necessarily limited space available has been very satisfactorily solved. The boiler is of the horizontal, return-tube type. The fire-box and smoke-box are at the front end and the gases of combustion pass through the fire tubes to an intermediate smoke box chamber at the back end, and thence forward through the return tubes to the smoke box. The barrel of the boiler, which is in one sheet 61⅝ ins. long, measures 49 ins., inside diameter, at the fire-box end and 44 ins., inside diameter, at the intermediate smoke-box end. It contains 214 fire

tubes, 1¼ ins. in diameter and 3 ft. 9 ins. long. There are an equal number of return tubes of the same diameter, but 3 ft. 11½ ins. long. The total heating surface of the boiler is 624.4 sq. ft., which gives 2.5 sq. ft. per HP. Of this heating surface, 527.8 sq. ft. is in the tubes and 37.6 sq. ft. is in the fire box and the remainder is in the superheater.

The fire-box is 33⅛ ins. long and 43¼ ins. wide and is bricked for burning oil. The oil burner, which is located in the fire door, is of special design and is provided with a fan-shaped deflector which throws the oil downward toward the hot fire bricks and also spreads it out over the fire-box, thereby helping to produce perfect combustion.

The superheater is of the smoke-box type and is located in the intermediate smoke-box chamber where the temperature of the gases is high. The superheater tee head is bolted to a cast-steel, box-saddle casting, which in turn is bolted to the top of the boiler, and covers the opening cut in the sheet through which the superheater tubes extend down into the smoke-box chamber. The tee head is divided transversely into a front and rear compartment by means of a vertical partition. There are sixteen superheater tubes bent into the shape of a double loop, one end of each loop being connected with the front or saturated steam compartment, and the other end with the rear or superheated steam compartment. Steam flows from the dome through a short dry pipe into the saturated steam compartment; and thence through the superheater loops into the superheated steam compartment; and from thence into the steam pipe to the high-pressure steam chest. The throttle valve controls the flow of saturated steam into the superheater. The boiler is rigidly connected to the motor truck frames, so as to eliminate the necessity of flexible steam joints. The various parts the complete motive-power unit are recogni in Figs. 1, 2 and 3.

The engine is of the two-cylinder, cros om- pound type, the high-pressure cylinder be 9¼ ins. in diameter by 12 ins. stroke and th ow

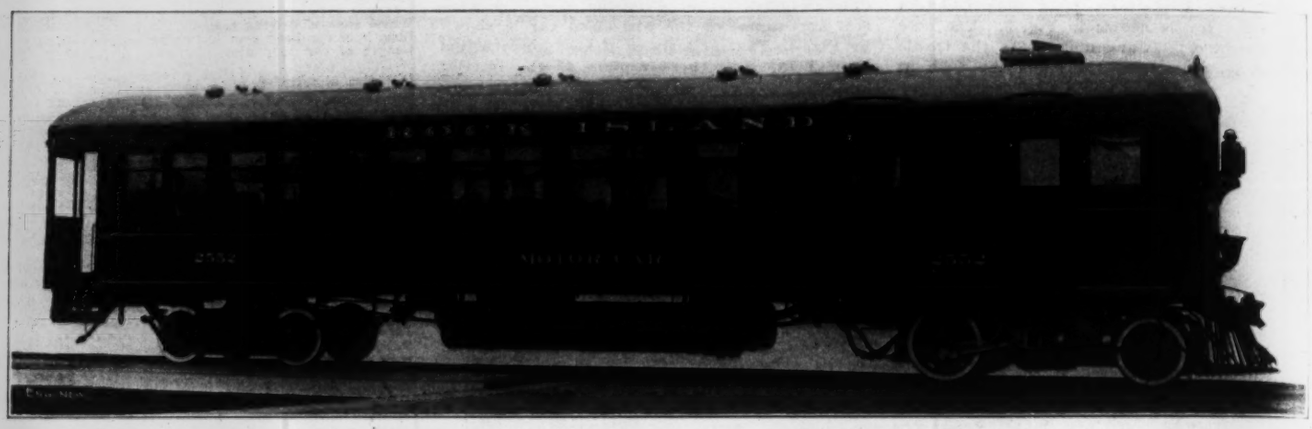


FIG. 1. STEAM MOTOR CAR OF THE CHICAGO, ROCK ISLAND & PACIFIC R. R.
(Built by The American Locomotive Co., at their Schenectady Works.)

The engine is of the two-cylinder, compound type, the high-pressure cylinder being 14½ ins. in diameter by the same stroke. The Mellin system of compounding is used, the intercepting valve being located in the high-pressure cylinder casting. Both cylinders are equipped with piston valves actuated by a Walschaert valve gear. The cylinders are in separate castings and are rigidly bolted to the side frames of the motor trucks. They drive on the rear wheels of the truck only. These are 38 ins. in diameter. With a boiler pressure of 250 lbs. the engine will develop a theoretical maximum tractive effort, working compound, of 4,300 lbs.

The motor truck is of the four-wheel, swing-

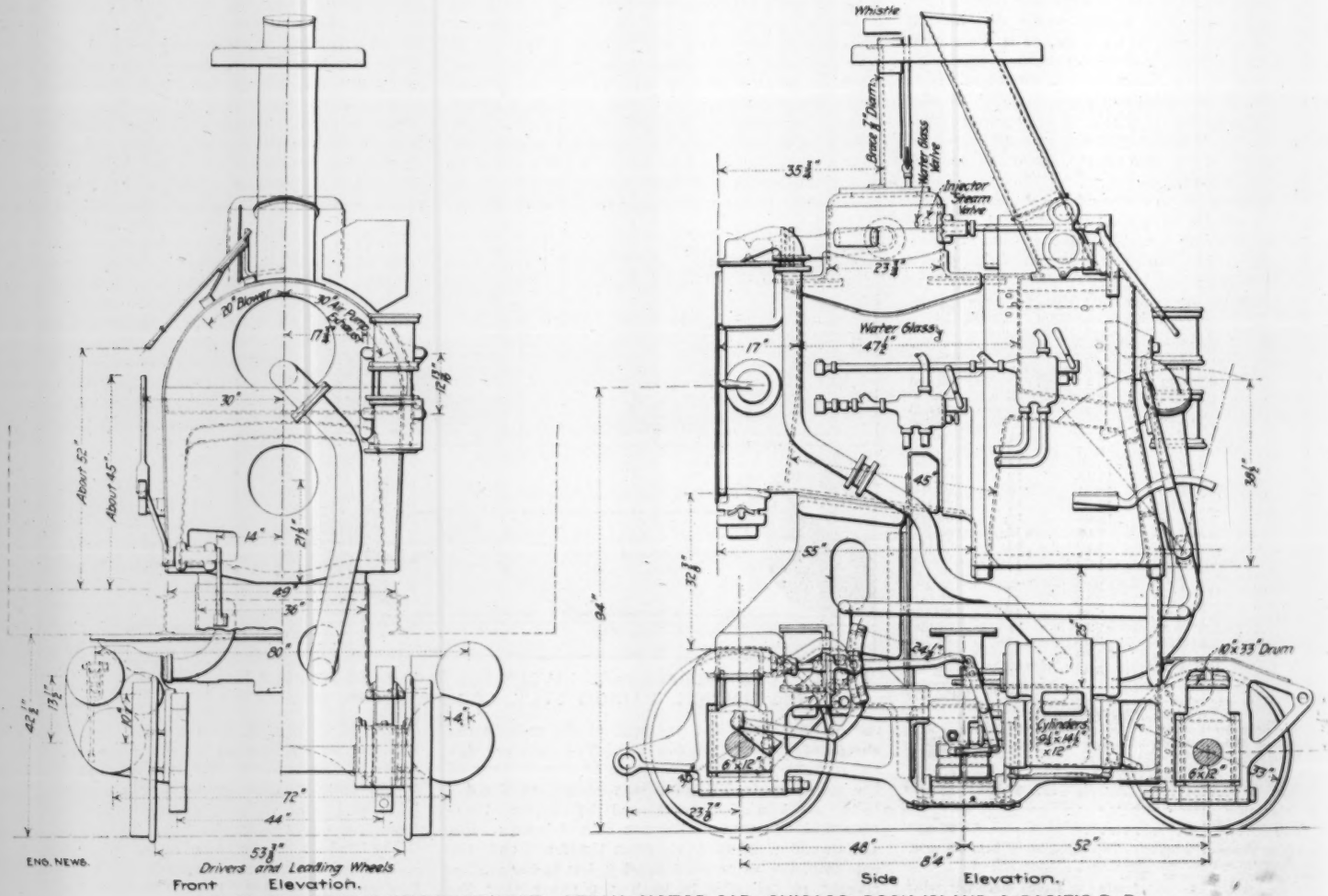


FIG. 4. ELEVATIONS OF POWER UNIT. STEAM MOTOR CAR; CHICAGO, ROCK ISLAND & PACIFIC R. R.
(Built by The American Locomotive Co.)

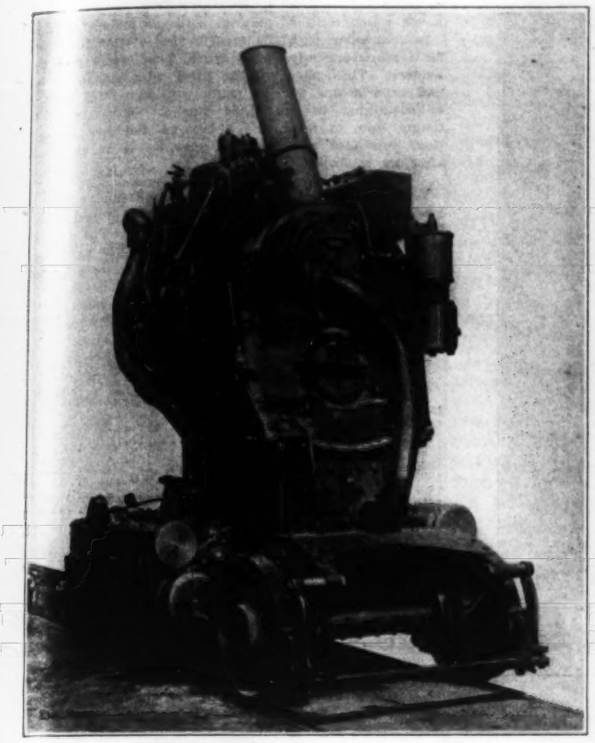


Fig. 2. Front View.

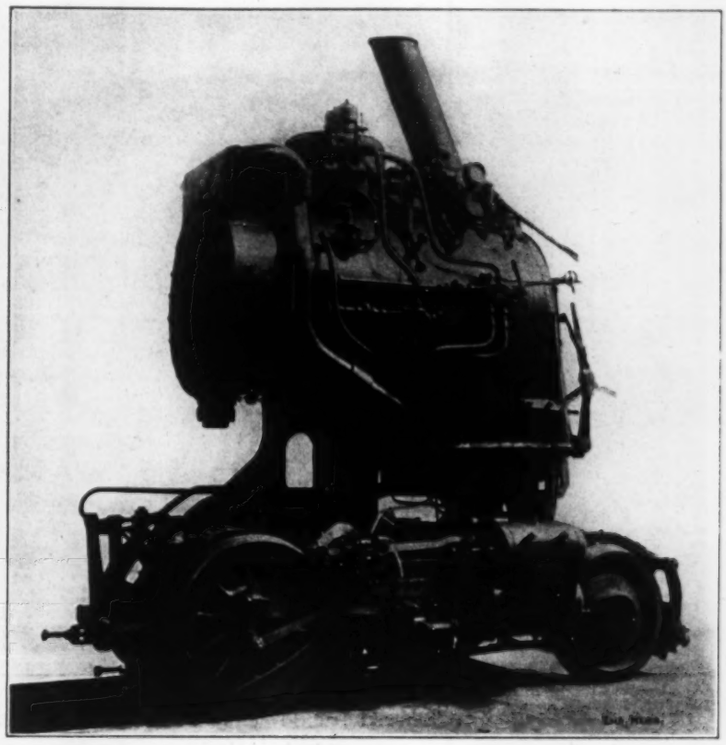


Fig. 3. Side View.

FIGS. 2 AND 3. GENERAL APPEARANCE OF THE POWER UNIT, STEAM MOTOR CAR; CHICAGO, ROCK ISLAND & PACIFIC R. R.

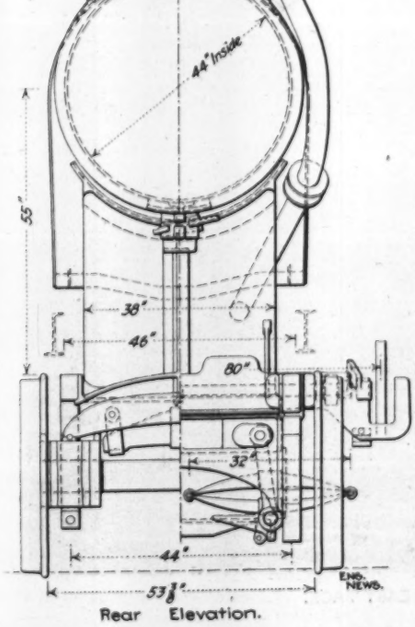
ing bolster type. The side frames, which are of cast steel, are 3½ ins. wide and are rigidly tied together by the cast-steel transoms and by cross-ties suitably placed. The bolster is carried on double elliptic springs. The weight on the rear or driving journals is carried by a semi-elliptic spring, suspended between two cross equalizers, whose ends rest on top of the journal boxes. The weight on the forward journals is carried by coil springs, one on top of each journal, thus giving a three-point suspended truck.

The trailer truck is of the four-wheel, two-bar, equalizer type having solid, wrought-iron, top-frame swinging bolsters of the built-up type, channel-iron transoms and cast-steel transom gussets. The wheels are 34 ins. in diameter and the journals are 4¼ × 8 ins. Both motor and trailer trucks are equipped with air brakes. There is the usual air-signal and car-heating equipment.

The fuel oil is carried in a 100-gal. tank in the engine compartment. The water supply is carried in three tanks, having a total capacity of 1,000 gallons, suspended beneath the car midway between the trucks.

The principal dimensions of the car are given in the accompanying table.

For the description, drawings and photographs of this motor car we are indebted to the American Locomotive Co., 30 Church St., New York City.



Rear Elevation.

AN INTERESTING ARCH FAILURE.

A rather costly failure of masonry arch construction occurred last week at the new Police Headquarters building under construction in New York City. A porte-cochère projecting from the building, having arched openings in the three exterior walls and a brick arch roof, failed on July 2 in the way shown by the three views herewith. The roof arch collapsed completely, and the arches over the driveway openings in the side walls broke down and all but fell.

This building occupies the triangular block between Center, Broome, Baxter and Grand Sts. At the narrow northern end it is extended to form a porte-cochère about 25 ft. square. This is a one-story structure of cut stone, covered by a brick arch. The arch was faced with tile laid flat. Its rise was about 3 ft. Apparently there were no tie-rods to take its thrust, and the stability of the walls of the portico was relied on for the purpose. There were openings in the east and west walls, covered by flat arches spanning about 12 ft., whose thrust also came against the north wall. The corner piers of this north wall were not of full rectangular section but consisted only of the adjoining sections of end and side wall, as is suggested by Figs. 1 and 2.

The effects of the arch trust are clearly apparent from the views, especially from Fig. 1. The lower part of the pier at the left is uninjured and apparently still in vertical position. The upper half, however, is broken apart by tipping and shearing and is shifted northward. Similarly in the east face, Fig. 2, it is seen that the upper part of the pier has been pushed over northward, dropping the arch stones and the cornice. Both side walls are bowed outward several inches at the middle of the cornice. The north wall itself shows no distortion east and

FIG. 1. VIEW FROM NORTHWEST.

FIG. 2. VIEW OF WEST FACE.
COLLAPSE OF A PORTE-COCHERE AT THE NEW POLICE HEADQUARTERS BUILDING, NEW YORK CITY.

west (see Fig. 1) but is bent outward in a northerly direction.

The accident was somewhat complicated by the fact that the excavation for the city's bridge-loop subway, through Centre St., comes close to the westerly side of the building, the wall of the latter being some 6 ft. away from the sheeting of the trench. Further, there is a street-car line in Centre St., turning eastward into Broome. It was surmised that the subway excavation work and the vibration of the car traffic might have affected the foundations of the porte-cochère, although the foundations were built some time after the subway trench had been excavated and sheeted. The engineers of the Public Service Commission took levels of the foundations and found no settlement whatever, thus disposing of the surmise.

Aside from this, the appearance of the structure in the views Figs. 2 and 3 is sufficient to destroy any claim as to influence of foundations. The failure of the piers is restricted to their upper part, and the picture of destruction by excess of thrust over resisting stability is convincing.

The building was designed by Hoppin, Koen & Huntington, architects, of 244 Fifth Ave., New York City. It is being built by Thomas & Oppenheimer, lawyers, for a committee of creditors of the original contractor.

AN EXPERIMENTAL STATION FOR THE INVESTIGATION OF COAL MINE EXPLOSIONS.

A Congressional appropriation of $150,000 is now available for an investigation by the United States Geological Survey of the causes of and remedies for the mine disasters which resulted in the death of 3,200 coal workers during the last year. It is expected that by Aug. 1 a complete experimental station will be in operation on the grounds of the Arsenal in Pittsburg, Pa.

*Here tests of the various dynamites and powders used in blasting coal will be made with a view to accurately determining their safety in the presence of fire damp and coal dust. Explosives of all sorts will be hurled by means of a mortar into a mammoth boiler-plate cylinder, which has previously been filled with gas, and the effects will be carefully noted. If ignition fails after severe tests the use of these explosives will be urged upon the mine owners of the country.

That part of the experimental station in which the explosives are to be tested will be in the form of a cylinder, 100 ft. long and 6 ft. in diameter, lying on the ground. An explosive mixture of fire damp and air in one case or coal dust and air in another will be pumped into the cylinder and the explosive to be tested will be shot into it from one end by a big steel mortar, so that the flame and products of combustion will go right into the explosives.

The cylinder in which the explosions are to occur are to be made of heavy boiler plate. Safety valves will be placed all along the top and will be left unfastened in such a manner that whenever there is an explosion the valves will fly open upon their hinges. A series of port holes on the sides, covered with ½-in. glass, will enable those conducting the experiments to witness the explosions from the observation house, 60 ft. away. The steel mortar which will hurl the explosives into the cylinder will be fired by electricity from the obs[illegible]on house which is to be parallel with the cylinder [illegible].

In connection with the experimental station th[illegible]ill be a miniature mine with drifts, headings, roo[illegible]nd ladders. This place will be filled with smoke [illegible]as and experiments will be made with apparatus [illegible]ble of sustaining life in these vapors. Miners [illegible]be taught how to wear this apparatus and how [illegible]ve their comrades who may be unconscious in th[illegible]ne after an explosion.

*New York Journal of Commerce, June 27.

VARIATIONS IN AVERAGE PRICES during [illegible]18 years since 1890 are summarized in a table just [illegible]ed by the Bureau of Commerce and Labor. The [illegible]ge price from 1890 to 1899 is taken as 100. The ave[illegible]is made up from the wholesale prices of 258 staple [illegible]es and the figures may be taken as representing the [illegible]a-tion in the cost of living or the changing value [illegible]he gold dollar, since the value of a dollar is really me[illegible]red by the amount of goods it will purchase.

Year.	Relative price of all commodities.	Year	Relative price of all commodities.
1890	112.9	1899	101.7
1891	111.7	1900	110.5
1892	106.1	1901	108.5
1893	105.6	1902	112.9
1894	96.1	1903	113.6
1895	93.6	1904	113.0
1896	90.4	1905	113.6
1897	89.7	1906	122.5
1898	93.4	1907	120.5

WATER AND SEWAGE PURIFICATION PLANTS for Toronto, Ont., for which appropriations of $750,000 and $2,450,000, respectively, were voted by a large majority on June 27, will be proceeded with as soon as possible. The water filtration plant will be built on an island in Lake Ontario. It is expected that Mr. Allen Hazen, M. Am. Soc. C. E., of New York City, will prepare plans for the water filtration plant. A high and a low-level sewer will be built to carry the sewage of the eastern part of the city to a point near Ashbridge's Bay. Here will be constructed a pumping station, a sedimentation basin and septic tanks. The effluent from the septic tanks will be discharged into deep water in the lake about four miles from the water-works intake pipe. The general scheme for sewage disposal has been approved by the Provincial Board of Health of Ontario, and plans are now being prepared under the direction of Mr. C. H. Rust, M. Am. Soc. C. E., City Engineer of Toronto. It is hoped that work on the sewage disposal scheme will be begun this fall. These proposed improvements are the outcome of a number of years of agitation and investigation, during which several reports have been made by Mr. Rust and others, including a report by Mr. G. R. Strachan, M. Inst. C. E., of London. (An abstract of Mr. Strachan's report, with editorial comment, appeared in Eng. News, Sept. 6, 1906.) During the investigations Br. Rust has made one or two trips abroad for the purpose of gaining information on the latest sewage works practice there.

FIG. 3. VIEW OF EAST FACE.

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The Government report of internal commerce for May indicates with great clearness the reason why some 300,000 freight cars were idle during that month. The falling off in traffic can be traced almost wholly to the lull in the building industry and in the iron and steel business. The raw materials in these two industries make such enormous demands on transportation facilities that a decrease in activity is at once reflected in railway traffic conditions. In other lines transportation is practically at normal volume. The tonnage of anthracite coal moved during May, 6,088,116 gross tons, was the largest monthly total ever recorded, and the five months total since Jan. 1, amounting to 26,963,590 tons, is also the largest for that period.

In contrast with this, coke production in the Connelsville district for the four weeks ending May 30 was 669,217 net tons, which is almost a million tons below the output for that period in 1907. Less than half the number of cars has been used in shipping coke that was used in 1907. The decline in the building industry is reflected in a heavy falling off in number of shipments from Pacific coast points.

American law makers who are seeking to solve the knotty problem how the State may effectively control great corporations might with good advantage study the innovation which on July 1 went into effect in Great Britain. This innovation, in brief, is the division of corporations into two classes, private companies and public companies. In the United States all corporations stand on the same footing except as they may be affected by laws governing different lines of business. Thus if two partners organize a corporation, in order to avoid liability for each other's debts incurred in the business, they are controlled by the same laws that govern a corporation with ten thousand stockholders doing business all over the country.

When it is proposed to adopt some measure of control or regulation or enforce publicity in the conduct of "the Trusts" so-called, the objection is raised that the private business of the small concerns is being interfered with.

To meet this situation Parliament has now enacted a law under which companies having not more than 50 stockholders, which do not issue any public invitation for subscriptions to their stock, and which restrict the right to transfer their shares, may be registered as private companies and are then freed of certain requirements regarding publicity, the filing of reports, etc.

It becomes increasingly evident that the same principle must be followed in the United States if really effective regulation of the great corporations is to be attained. Otherwise eminently proper and necessary measures for safeguarding public rights will bear so hardly on a multitude of small corporate enterprises that it will be impossible to secure their enactment.

According to current press reports, the committee on supplies of the New York City schools proposes to continue the enforcement of their previous instructions to firemen and janitors for "burning" ashes after sprinkling them with a solution of rock salt and oxalic acid. It is said that by the use of this solution 10,000 tons of coal have been saved this year; from 10 to 70% of the supply at the various buildings.

As pointed out editorially in Engineering News, May 14, any benefit derived through the scheme employed is due to an indirect and unintentional improvement of combustion conditions or to the utilization of carbon most reprehensibly allowed to pass into the ashes. If, instead of buying oxalic acid and salt, the board would have an expert examination made of all local boiler-room conditions and a scrutiny of the firemen themselves, a still greater economy should result. Incidentally the political sponsors of education in this metropolis would be saved the absurdity of teaching chemistry in the classrooms and practicing alchemy in the boiler room.

The results of the survey made by the Canadian Government for the Georgian Bay ship canal are set forth in this issue. Briefly summarized, the report states that a channel big enough to accommodate the largest lake steamers can be made from Georgian Bay to Montreal via the Ottawa River at a total cost just under $100,000,000.

By this route a vessel could pass from Port Arthur to Montreal in 70 hours, or inside of three days. The distance would be 934 miles, which compares with 1,216 miles distance between the same points via Lake Erie, the Welland Canal, Lake Ontario and the St. Lawrence canals. If, however, a new Welland Canal were built and a new series of canals around the rapids of the St. Lawrence for the same capacity vessels as the Ottawa River route and with the reduced number of locks that would naturally be used, then it is probable that a steamer could make the passage by the lower route is as short a time as by the Ottawa.

It would seem well worth while, therefore, to make a survey of the St. Lawrence route before deciding definitely on the Georgian Bay project. The St. Lawrence route would be all located in a well inhabited and readily accessible region, and would be freer from troubles with ice than the route via the Ottawa River. It would, on the other hand, be difficult to construct new canals for 22-ft. navigation along the St. Lawrence without interfering with the present 14-ft. canals, and perhaps suspending navigation in them for several seasons. The balance of advantage, however, would seem to rest with the St. Lawrence route compared with that by the Ottawa if the cost were no greater.

But the feature of greatest interest in the report is that it is now determined to be possible by most thorough surveys and estimates to make a deep waterway from the Great Lakes to the Atlantic for less than a hundred million dollars which is less even that the State of New York is expending in building a waterway to Lake Erie of barely half the depth. This waterway would be large enough not only to bring the lake vessels down to the sea but to admit to the lake ports nine-tenths of the merchantmen doing business on the ocean. It opens up possibilities of cheap transportation from the interior of the continent to the seaboard that are of the greatest importance not only to Canada but to the United States.

CONCERNING PUBLIC DEBTS.

There was a time—well within the memory of men still living—when people in general had a dread of debt. A debt unpaid at that day might mean a debtor's prison. The horrors of those old-time abodes of evil have been painted by Dickens and other great writers. No one could wish for a moment to step backward toward the dark ages of which they represented a survival. Yet it is idle to deny that at the present day we have come to look too lightly on debt and its consequences.

In business, of course, debt is a necessity of our modern commercial systems. We have come to hardly count as debts the current borrowings from banks. Almost every business carried on with its own capital alone will have at one time of the year a surplus of cash, at another a need for more ready money than current revenues supply. The bank has become a reservoir into which the surplus funds flow as deposits and out of which loans can be furnished, and the same man who at one time of the year has a large surplus will at another season be a heavy borrower.

But it is an easy step from debt incurred for business purposes to debt incurred for private purposes. Men light-heartedly mortgage their homes to buy automobiles. They cheerfully pay exorbitant prices for pianos or books to be paid for in instalments rather than deny themselves for a few months in order to save money enough to buy for cash at a much lower price. They merrily mortgage the future for the sake of the present and shut our eyes to the dangers and penalties and suffering and woe that often and often follows when the present becomes past and the future day of payment comes.

When men regard lightly private debts, which bear on themselves, is it strange that public debt should likewise be a light matter? Rather the strange part is that the public, as a whole, retains so much as it does of regard for public honor and honesty and sound finance. There are, however, all the time attacks upon this still remaining regard for public solvency. When a popular vote is had on any question which means the incurring of a large public debt, one sees always appeals to laboring men to vote in favor because it will give them employment. Surely that way danger lies; grave danger.

When the initiative and the referendum—with all their excellent and admirable features—open the way by which great public expenditures can be ordered for the sake of giving employment to present and shut their eyes to the dangers and labor, then burdens may be laid on property, upon production, upon the taxpayer and the rent-payer, of which we little dream now.

We live in an era of vast public debts; and the public is growing accustomed to them and ceases to regard them with dread or opposition. Our national debt, which assumed such portentous size during the civil war, was rapidly paid off in the '70s, and '80s; and had the same rate been continued would long since have been entirely extinguished. But the debt-paying policy was suspended in the financial crisis of the early '90s. The debt was added to then for the sake of maintaining the currency system on a gold basis and later to meet the emergency of the war with Spain. The flood tide of prosperity of the present decade has not been taken advantage of to pay off the national debt. Instead the public policy has been gradually altered; long-term extensions at low rates of interest have been chosen rather than payment of bonds as they become due. And no section or party has raised a protest.

At the present time there appears much more likelihood that the national debt will be largely added to than reduced. If the public does not object to a great national debt why should the politicians? Why should they not seek the popularity and the advertising to be gained by ad-

vocacy of great expenditures? So we see our Hobsons (would there were only one) advocating a vast naval establishment—requiring, of course, an issue of bonds for its creation, to say nothing of the enormous burdens involved in its maintenance. Other eminent gentlemen besieged the recent national conventions with appeals for approval of half a billion dollars in bonds to raise money for waterway improvement. Still others would have an equal or greater amount borrowed for the purpose of Federal aid to good roads construction.

We shall refer to these schemes later; but let us now turn to our State governments. Except for the old debts of some of the Southern States, American commonwealths have, as a whole, been commendably free from the burden of debts; and when they have borrowed money for special purposes, they have made provision for its prompt payment. There is evidence, however, that the tide is turning. Large bond issues for road improvement have been made in New York and in Massachusetts. The former State is incurring a hundred million dollars of debt in building a barge canal across its territory and Illinois is to vote this fall on a $20,000,000 bond issue for waterway improvement. New York has fortunately imbedded in its constitution a requirement that bond issues must be paid off by sinking fund contributions within a brief period of years. It is to be hoped that similar policies may be the rule in other States and that the day may be far distant when the taxpayers and voters of our commonwealths may look with equanimity on a State debt as a thing to exist permanently.

Turning now to our municipalities, we find public debts increasing by leaps and bounds. The problems consequent on modern life in our centers of population have compelled the raising of money by borrowing. It would not have been possible to have built the sewers and systems of water supply and streets and parks and a dozen other great public utilities which have been created in the past 30 years by other means than by borrowing the money. All this is true, and yet there has grown up out of this a popular callousness to public debt which has its dangerous side.

A public debt means a public obligation. It means borrowing money on which interest must be paid and eventually the principal returned. The private individual when he borrows money looks forward to the means whereby the interest and the principal will be forthcoming when due. Why should not the same sound rule be applied to a public debt?

Undoubtedly public debts must be incurred and increased, particularly by our cities. Necessary expenditures in the next ten or twenty years are certain to enormously increase the aggregate of our municipal indebtedness. What safe rule can be followed as a guide to sound public finance?

There is one very easy and simple rule which holds good for public debts as it does for private debts. It is the rule that debts incurred for the purchase of income-producing property stand on a different basis from debts incurred to purchase luxuries or in general anything which does not yield a direct return. A business man will not hesitate to borrow money at 5% or 6% to purchase property yielding double this return. A city may safely borrow money at 4% to build a system of water supply, the revenue from whose operation will not only provide for the interest on the bonds, but build up a sinking fund which will pay them at maturity.

We do not join the chorus of alarmists who have taken the mere statistics of public debt in this country and in Great Britain and made out from them a diatribe against municipal ownership of public utilities. On the contrary, we would urge that the same rule be applied to cities or States that applies to private finances. A rich man may owe great sums of money, yet the debt gives him not the slightest concern, if it is all represented by valuable income-yielding property. So the cities of Great Britain, which have invested so heavily in such public utilities as gas works, street railways, docks and lighting plants, are often carrying no greater actual burdens of taxation than American cities whose debt represents for the most part works that yield no direct income.

This distinction has been officially recognized in New York City, where the debt incurred to provide a new system of water supply is not included in computing the debt limit or proportion of the assessed valuation beyond which the city may not go in the issue of bonds.

And in our view of public debt it is important that we go a step farther. As one studies the subject finally, it becomes clear that the public debt of a city, for example, includes not only the bonds issued by the city itself, but the bonds issued by public utility companies, such as street railways, gas works, electric lighting plants, water companies, etc. It is true, of course, that the taxpayers are not directly holden for the payment of bonds issued by franchise-holding companies. On the other hand, if the companies remain solvent, the money to pay the annual interest, and eventually the principal, must be collected from the citizens as part of the rates charged. This must be done just the same whether these utility plants are owned by the city or by private companies.

What we seek to emphasize is a view of public debt as a burden to be borne in the future by the taxpayer and the rentpayer. The productive earnings of any man or community or nation must carry the burden of interest and principal payments on the public debts before any margin is left for profit. From this broad point of view, all debts incurred for public utilities, whether privately owned or publicly owned, stand on the same footing.

Surely then, if we have regard for the prosperity and well-being of the new generation, just coming on the stage, the creation and increase of public debt is a matter for serious consideration.

By way of illustration, let us contrast the railway financial policy of two countries, Great Britain and France. In Great Britain the railways, all owned by private companies, have increased their capitalization, year by year, almost from their inception, until the average capitalization per mile has reached the stupendous figure of nearly a quarter of a million dollars. Thus the users of the railway must pay fares and freights so adjusted as to yield a return on this capital, and this is to go on perpetually. France, on the other hand, in granting to private companies the franchises for construction and the privilege of exercising the right of eminent domain, stipulated that at the end of a long term of years, not only the franchise, but the railway itself, with all its appurtenances, should revert to and become the property of the State. During all this time, therefore, the French people have been unconsciously paying for their railway system and a few years hence the French railway system will be the property of the people of France free of debt or incumbrance. It may be operated directly by the State or leased to private companies; but in either case the French people and French productive industry will be released from the burden of paying "fixed charges" on the first cost of the railways.

We believe this coutrast between the railway finances of two nations carries a significant lesson. Perhaps we can make it more significant by drawing another contrast. Suppose two cities should adopt opposite policies in the matter of public debts. The one goes on in the rut which too many American cities are following, adding to its load of debt for each new public work that progress makes desirable and leaving unpaid debts incurred for improvements that were long ago worn out or rendered obsolete.

The other city looks forward a long term of years to the time when debts must be paid and adopts the principles that public utilities should be made to pay for themselves and that it is as desirable for a city to some day reach the happy stage of owing no man anything as it is for a private individual. The city may, either by granting franchises for a limited term with reversion of property to the city, or by adopting municipal ownership, reach a time when the people of the city will own, free of debt, their water-works, lighting plant, street railways, parks, sewers and all the other paraphernalia of municipal housekeeping. Property and protection in such a city would be free from burdens carried in the other city struggling under a mountain of debt.

We believe these things deserve the serious consideration of all who have the public welfare at heart. Are public debts meant to be permanent burden? Is it reasonable that money borrowed to build the public improvements of to-day should be left for all succeeding generations, to pay interest time without end? Ought not the generation that has the benefit of a public works to pay for it, and not shirk the burden unto those who come after? Will not the people of 1930 and 1950 and 1975 have their own public works, to make demands on the municipal and national treasuries? Has not the ease with which a solvent city can borrow money at low rates of interest fostered the tendency to increase public debts and build works on borrowed money that might have been paid for outright?

As we have said above, we have no especial fear of public debts incurred for the creation of income-producing enterprises, provided, of course, such enterprises are judiciously planned and financed and operated. We do fear the creation of great public debts for the other class of improvements—those advocated merely on the score of general benefit.

Good roads are good things when well located and well built; but we know of no reason to justify building roads on borrowed money and passing over to distant years the burden of repayment. Waterways properly planned promise a large measure of usefulness; but the nation is rich enough to raise by taxation the money needed for waterways as fast as they can be properly constructed.

A man is on very dangerous financial footing who borrows a large sum with no fixed plans for its use and sets him down to consider what he can do with it. The danger to the nation in a huge bond issue for waterways or for good roads is that many waterways and roads whose improvement is wholly unwarranted would rush forward and claim a share in any such huge slice of Uncle Sam's pie.

LETTERS TO THE EDITOR.

An Engineer's Chances in the Shipbuilding Industry.

Sir: If your correspondent, signing himself "G" in issue of July 2, thinks an engineer's chances of advancement have reached their lowest point in railway work, I would advise him to talk with some of the profession engaged in American shipbuilding under our present policy and he may change his views.

T. J. Smith.

Newburgh, N. Y., July 7, 1908.

Flood Stages in the Lower Mississippi in 1908.

Sir: Referring to the very interesting correspondence on the question of "The Reservoir System of River Control," which has appeared in Engineering News of recent dates; it is not the present purpose of the writer to enter into the controversial phase of the question, either pro or con, as it has been ably handled on both sides.

The object of this note is to call attention to the somewhat remarkable exemplification this season, and by natural process of the effect upon Mississippi River floods of withholding the "crest of the flood" in the Ohio valley while the western tributaries are in flood, under which conditions we have had quite recently, the curious situation of very high and destructive river stages at both extremities of the Mississippi River drainage system (west of the Ohio valley), with very moderate stages in the intermediate portions.

Beginning early in February there was a prolonged series of floods in the Ohio valley, with six culminations at Cincinnati, covering a period of nearly four months, the western streams being all relatively low during that period. While a very large volume of water in the aggregate passed out of the Ohio, it was so distributed as to produce comparatively moderate flood stages at and below Cairo, which were at no time during that period sufficiently high to create any strain on the levees that demanded attention; so that none of the preparations for fighting high water, usual in dangerous

floods were found necessary in this part of the river, and there was no "high-water fighting" to be done.

While the last of the Ohio floods was exhausting itself there occurred a series of storms of phenominal magnitude, covering the entire region of the drainage areas of the western tributaries, including the upper Mississippi itself, but which did not extend far enough eastward to involve the Ohio drainage system. During the prevalence of the series of Ohio floods the Cairo gage had four principal culminations, beginning with Feb. 26 and ending with May 20, the maximum difference between them being only one of a foot, and the highest being about six and a half feet (6.67) below extreme high water.

About the time of the last culmination at Cairo, the St. Louis gage began to assert its power on Cairo, reaching 21 ft. (a serious stage for St. Louis) on May 18, and with a slight subsequent decline going up to 34.9 (a very high stage for St. Louis) on June 20. This, however, did not prevent a rapid fall at Cairo, which declined 8.5 ft. in 8 days, and under the influence of the St. Louis gage was held to approximately the same stage for 30 days, from May 28 to June 27, when a somewhat more rapid decline set in. The Ohio and tributaries had since May 13 been steadily falling until something like low water stages were reached.

In the mean time the Red and Arkansas rivers, the principal lower western tributaries, were enormously engorged by a succession of extraordinary storms, resulting in very nearly the record stage at New Orleans on June 22. Extreme flood conditions prevailed from the mouth of Red River to the gulf, while the conditions were much modified between the Arkansas and Red rivers, the flood stage at Vicksburg being 4.58 below extreme H.W., and still more moderate above the Arkansas, Helena's highest stage being 6.55 below the highest record.

The general result has been an unusually prolonged moderately high stage of the Mississippi River, from Cairo to the mouth of Red River, sufficient to cause the suspension of nearly all levee work since early in February, but not high enough to put the levees under dangerous strain; while since about June 1 all of the western rivers, together with the Mississippi below Red River, have experienced extraordinary flood conditions.

The situation is further illustrated by the following tabulation of culminating stages at various points:

CULMINATING STAGES AND DATES.

Gage.	Date	Stage. ft.	Highest Record.		
Cincinnati,	Feb. 20	51.10	(1884) 71.06		(phenomenal)
"	March 11	53.20	(1907) 65.10		(very high)
"	March 24	48.90			
"	April 4	55.70			
"	April 14	49.50			
"	May 9	44.10			
Cairo,	Feb. 26	44.90	(1883) 52.17		
"	March 18	45.50			
"	April 13	45.30			
"	May 20	45.10			
Helena,	March 5	44.20	(1897) 51.75		
"	March 27	45.20			
"	April 22	44.60			
"	May 26	44.40			
Vicksburg,	June 10	47.90	(1897) 52.48		
New Orleans,	June 22	20.00	(1903) 20.30		
St. Louis	June 20	34.90	(1844) 41.39		(phenomenal)
"	.....		(1903) 37.90		(very high)

It is evident that if it is practicable by the Reservoir System to restrain the "crest" of the Ohio floods, to the extent of 6 or 7 ft., as proposed, even maximum floods from that stream, other conditions being the same, should result in a situation similar to that of the present season; and in the absence of such extraordinary floods in the lower western tributaries as have prevailed recently, we should have "easy water" from Cairo to the Gulf.

One reflection is here offered in relation to the proposed Reservoir system; if found to be practicable, and if it should be embarked upon, its accomplishment would be the work of a generation. In the meantime the insatiable appetite of the Mississippi current for devouring its own banks, must keep levee building and channel dredging under continuous high pressure, with cumulative difficulties and cost.

The creating of stability of the banks of the Mississippi River from Cairo to the mouth of Red River, with resultant fixedness of the channel line, is the *sine qua non* of any plan for the general control and rectification of the river, the cost of which has been liberally estimated at $100,000,000.

Respectfully,

T. G. Dabney, M. Am. Soc. C. E.

Chief Engineer Yazoo-Mississippi Delta Levee District.

Clarksdale, Miss., July 3, 1908.

[Our correspondent's letter brings out clearly the intimate relation between flood heights in the lower Mississippi and the chances of coincident floods in its main tributaries. The water at New Orleans on June 22d reached nearly the highest mark ever recorded. This appears to have been the result of extraordinary floods in the Arkansas and Red Rivers, which reached New Orleans about the same time as the flood wave from the Ohio which passed Cincinnati on May 9. Had this flood wave from the Ohio been as great as those of February or March, the high water at New Orleans would doubtless have exceeded all records.

Engineering practice in predicting flood heights goes no farther at present than recording the high water marks of past floods. It is well to understand that in any stream of large size, with many tributaries, the flood height which may be reached is dependent on the chance of coincident floods in all the main tributaries; and there is always a chance, therefore, that all past records may be far exceeded, as has happened many times at many localities in the United States during the past dozen years.—Ed.]

Notes and Queries.

Mr. J. G. Palmer, 175 Fall St., Seneca Falls, N. Y., calls our attention to an error in the table of cost data in his article on "Cost of Shallow and Deep Sewer Trenches" published in our issue of June 25, 1908, p. 691. The fifth from the last line of the table should read

800 ft. of shallow 18-in. sewer, $1,619.44, per lin. ft., $2.024.

The totals are correct as printed.

"Subscriber" writes:

Would you please let me know a method for measuring the cubic contents of scows where they are loaded with a dip in the middle?

The usual method is to measure the dimensions of the sections at each change of bottom or side slope and from the areas, computed from such dimensions, compute the cubic contents according to any of the accepted volume formulas, preferably the "prismoidal formula" which is as follows:

$$V = \frac{1}{6} L (A + A^1 + 4A_m)$$

Where V = cubic contents.
L = perpendicular distance between sections.
A = area of one right section.
A^1 = area of other right section.
A_m = Area of section midway between.

THE OFFICIAL REPORT ON THE GEORGIAN BAY SHIP CANAL.

For several years past the Canadian Government has had a large force of engineers engaged on the surveys for a deep waterway large enough to permit the steamers on the Great Lakes to go down to the ocean. The route of this deep waterway is from Georgian Bay at the eastern side of Lake Huron to the head of the Ottawa River and down that stream to Montreal. The enterprise was promoted by a private company a dozen years ago and was afterward taken up for careful survey and examination by the Dominion Government.

On July 6 the Minister of Railways & Canals presented to Parliament a report upon the results of the survey, which is the first official information regarding it to be made public. We print below a summary of this report as published in the Ottawa "Evening Journal" of July 6.

The estimates presented herewith are based on a project for a waterway at least 22 ft. in depth.

The style of navigation proposed is known as the "dam and lock system," with slack water reaches between structures. The whole is designed on such lines as to enable boats of large size (600 × 60 × 20 ft. draft) to pass from Lake Huron, through pond after pond, to Montreal, the head of ocean navigation.

The project is essentially a river and lake canalization scheme, taking advantage of natural channels which fortunately can be made to form 80% of the distance, from Georgian Bay to Montreal.

ROUTE.

Of the 400 miles of projected navigation between the above-mentioned points, from 410 to 420 miles follow the course of some river or lake.

For that part of the route, from Georgian Bay to the height of land separating the water sheds of the Ottawa River and the Great Lakes, a distance of 81 miles, the French and Pickerel rivers and Lake Nipissing are utilized. From Lake Nipissing, through the height of land, for a distance of 3½ miles, the route is an artificial waterway, with the exception of a few small lakes through which it is located.

This artificial cut leads into Trout Lake, thence into Turtle Lake, the Little Mattawa River and Talon Lake, which is utilized as far as Sand Bay at its southern end, a distance altogether of 21 miles, Trout and Talon lakes referred to above are very deep and fairly large bodies of water.

From Sand Bay there is a canal for three miles to the Mattawa River, which is utilized as far as the town of Mattawa, a distance of 13 miles, where another canal cut of 3-4 miles in length makes an entrance into the Ottawa River.

This river, which expands into large and deep lakes in many places, is followed all the way down to the foot of the Lake of Two Mountains, a distance of 293 miles.

From the foot of Lake of Two Mountains to Montreal, a distance of 25 miles, either the St. Lawrence River or the Ottawa River, called Rivier des Prairies, flowing north of the Island of Montreal, may be utilized. The former route is five miles of artificial waterway and the latter about eleven miles.

By the first route the canal enters Montreal Harbor at its upper end. By the second route the St. Lawrence Ship Canal is joined at Bout de l'Ile, some eleven miles below the eastern boundary of Montreal harbor, or seventeen miles below the city Custom House.

DISTANCES.

Taking Port Arthur or Fort William as the starting point, the distance to Montreal via the proposed waterway is 934 miles, via Lake Erie and the Welland Canal 1,216 miles, via Buffalo and the Erie Canal to New York 1,358 miles, giving a difference in favor of the projected route of 282 miles, as compared with the present St. Lawrence route, and of 424 miles as compared with the Buffalo and New York route.

Comparing the distance from Fort William to Liverpool via New York we have: Fort William to Liverpool via Georgian Bay Canal, 4,123 miles; Fort William to Liverpool via New York, 4,929, giving a difference of 806 miles in favor of the Georgian Bay Canal-Montreal route.

TIME OF TRANSIT.

This is affected by the length of restricted channels on the route where speed has to be reduced and by the number of lockages and consequent delays. A close computation of the speed allowable in the different stretches, with about three-quarters of an hour allowed for delay in the passage of each lock, gives about 70 hours as the time of transit from Georgian Bay to Montreal.

With the advantage of shorter distance between terminal harbors it is computed that the route will be from one and three-fifths to two days faster than any other existing water route under present conditions from the head of the Great Lakes to an ocean port, apart from also having an enormous superiority as to carrying capacity. But as compared with the possible improved system of St. Lawrence canals to a depth of 22 ft., assuming that the number of locks would be greatly reduced, probably no practical benefit in the time of transit could be claimed, the saving in distance being off-set by the longer stretches of lake and wide river navigation which exist through the Lake Erie and Lake Ontario route, where higher speed would be permissible.

CHANNELS.

The total length of what may be termed canal cutting for the entire route is about 28 miles, by the project connecting the St. Lawrence River above Montreal, through Lake St. Louis, and 34 miles should the Riviere des Prairie route be selected.

The length of submerged channels to be excavated is about 60 miles in stretches of varying lengths. Apart from this there is an aggregate of 14¼ miles where obstructions such as shoals, sharp bends, etc., have only to be removed to form very wide channels.

Therefore, of the 440 miles constituting the waterway, 108 miles will require excavation work for locks, approaches, canals, submerged channels, etc., leaving 332 miles of natural river or lake channels, which will not require any improvement beyond the raising of the water surface as recommended in connection with the project. Taking into account the 14½ miles of obstructions which, after removal, will leave wide, free channels, the route may be subdivided as follows, in relation to width:

	Miles.
Canal cuts, 200 to 300 ft. wide, including necessary restrictions at locks	28
Improved channels, submerged sides, 300 ft. wide	66
Free channels, 300 to 1,000 ft. wide and over	346
Total	440

The relative length of canals and submerged channels may be varied slightly as it is an open question as to the exact point where the one ends and the other begins.

The sides of all submerged cuts will be shown by piers or clusters of piles at suitable distances to indicate the channel, and to aid the vessels in navigating. Along curves these piers will be provided and each different course will be defined by ranges.

The restricted channels are widened at all ends, and conditions for navigation in these restricted parts will be as good, it is expected, as on the St. Mary's River or the St. Clair and Detroit River channels.

The depth of 22 ft. selected for the waterway will more than equal the conditions as they exist to-day in the channels connecting the waters of the Great Lakes, the St. Mary's River, Hay Lake, St. Clair Flats Canal, and the Detroit River.

The improvement carried out for these lake channels since 1892 contemplated a depth of 20 ft. below the mean

water surfaces, as determined up to that time. Since then, however, the prevailing water levels of Lake Huron, St. Clair and Erie have been almost continuously below the mean stage as formerly determined, and in consequence the actual draft available on account of lake fluctuations has been only from 17 to 19 ft.

It has, therefore, been found necessary to extend this depth, and some of these channels are now being deepened to 21 and 22 ft. in order to obtain a safe 20-ft. draft at all times. The Georgian Bay Ship Waterway, therefore, with a minimum depth of 22 ft., will compare favorably with any of the channels above mentioned which govern the draft of boats on the Great Lakes.

The mileage of excavation in canals and channels for the route may be subdivided as follows for each class of material encountered:

Dry Excavation—Rock, about 25 miles; earth, about 13 miles; mixed earth and rock, about 20 miles; total, about 58 miles.

Wet Excavation—Rock, about 18 miles; earth, 16 miles; mixed earth and rock, 16 miles; total, 50 miles; grand total, 108 miles.

This mileage includes all points which are to be dredged or excavated, whether canal cuts, submerged channels or shoals. A small percentage of the excavation given as submarine rock work might possibly be done in the dry, and the cost, therefore, reduced. In the estimates, when doubt existed, the rock excavation has been invariably classified as wet rock.

TERMINAL HARBORS.

As the harbor of Montreal forms the eastern terminus of the waterway, no special provision is made in the estimates for increased terminal facilities. By the time the waterway is completed, with the works now under construction and the extensive improvements proposed, the harbor will no doubt afford sufficient dockage facilities to meet the requirements of the increase in traffic contributed by the new route. As this traffic develops, facilities will be extended naturally as part of the harbor works.

The western entrance to the waterway on the Georgian Bay is formed by French harbor. As this will be only a transit point to and from terminal harbors already established, no terminal facilities are required other than improvements in certain parts of the entrance, and increased aids to navigation. These improvements are included in the estimate.

SUMMIT.

The summit level embraces Lake Talon, the Little Mattawan River, Turtle and Trout Lakes, their present surfaces being raised to elevation 677. Talon Lake will be raised 41 ft. and Trout and Turtle about 15 ft. above their present level. The locks at both ends of the summit are designed to allow of the large lake thus created, being lowered to elevation 671, without interfering with navigation. In fact, besides affording a wide and unobstructed route for shipping in transit, the lake will have two important duties; to absorb part of the excess in floods and to store the reserves for the months of deficient water supply.

From the careful hydraulic investigations made, the available supply from the summit watershed, with the storage provided, will be 540 cu. ft. per second throughout the season of navigation, which will allow of an average of 24 passages per day or 5,040 passages for the navigation season. As the traffic develops, in the event of this supply being insufficient to meet the demand upon the summit, the supply can be augmented by 700 cu. ft. per sec. by creating storage reserves at the head of the Amable du Fond River, and diverting it from the present outlet into the Summit Lake. This can be accomplished at an expenditure of $900,000.

These two sources of supply will more than meet the requirements at the Summit, should the waterway ever be worked to its full commercial capacity.

LENGTH OF NAVIGATION SEASON.

From the investigations made, the opening and closing of navigation on the waterway would coincide closely with the opening and closing of ocean navigation for the harbor of Montreal, the length of the season being perhaps a few days shorter.

This would be governed by Lake Nipissing and conditions at the summit and the Mattawa reaches, and the indications are that an average of 210 days each year would be available.

LOCKS.

The difference in elevation of 659 ft. between Montreal and the summit level, and of 99 ft. between the summit and Georgian Bay is overcome by 27 locks ranging in lift from 5 to 50 ft. By the Riviere des Prairies route, however, this number is reduced to 26.

All locks are designed to be built of concrete.

Regarding their size, lake boats have attained a length of over 600 ft., and the minimum dimensions of lock chamber should not be less than 650 in length by 65 ft. in width. The estimated cost of the locks is based on these dimensions, but in the final report the additional cost of building these locks 800 ft. in length by 75 ft. in width, should it be found desirable, will be given. In all cases the depth of water on the sills will be 22 ft. at extreme low stage.

DAMS.

The navigation scheme requires the building of 45 dams of various sizes, not including those which will be required in connection with the system of storage reservoirs.

Generally, where the quantity of water is much above the canal requirements, the rock-filled type of dam has been adopted. Where, however, it is important to economize water for lockages, concrete dams have been designed. The estimated cost is based on these two kinds of dams and the stop log system of regulation of sluices has been adopted throughout, with the exception of a few locations where Stoney sluices are deemed necessary.

STORAGE.

Intimately connected with the navigation scheme is the question of control of the flood waters of the Ottawa River. This would be of a great benefit to navigation as well as to industries along the river depending on water power. It is intended to effect this by creating large storage reservoirs so regulated that during flood season they will retain a portion of the surplus waters which will be gradually released during low water period. This question will be discussed in the report, but cannot be closed, as a complete solution of the problem will require more extended investigations than it has been possible to make so far.

WATER POWERS.

The present plans for the construction of the canal entirely alter the general features of the river. For the purpose of lockage, the falls are concentrated, and all of the small rapids obliterated. The dams built for navigation purposes, by concentrating the fall at one point eliminates the greatest difficulty in the development of the water powers. In addition, the needs of navigation require the elimination of extreme high water by the construction of a system of storage reservoirs at the upper reaches of the Ottawa River and its main tributaries, the water stored to be released at low water period, thus increasing the average low flow for power purposes.

The data collected up to date show that nearly one million horse-power can be secured along the Ottawa and French Rivers by the improved method of development. It is doubtful if more than 150,000 HP. at minimum flow could be developed under present conditions.

This question of water power is still being investigated as more data has to be collected.

It may be mentioned, however, that Chaudiere powers are not interfered with by the project. In the case of undeveloped water powers which are destroyed and which have been leased or sold by the Ontario or Quebec governments, a certain sum has been placed in the estimates to cover possible claims. No doubt in many cases it will be possible to compensate the claimants by giving them power privileges at some of the dams built in connection with the project.

The final report will give all the information available regarding this question.

DAMAGES.

On several of the reaches considerable land will be flooded permanently. Most of this land is now every year inundated from four to six weeks. The area so flooded has been computed for each reach, and the amount to be paid included in the estimate at a fair value per acre. In the case of damage to buildings the cost of their removal to higher ground or purchase has been considered and provided for.

TIME OF CONSTRUCTION.

A careful analysis of the work to be performed, shows that it would take from three to five years to develop all contracts and place the whole route under active construction. Some of the sections where heavy submarine excavation is encountered would require at least five years to complete under the best conditons of labor and equipment. It may be fairly stated, therefore, that a period of ten years from inception would be necessary to open the waterway to navigation. This would mean an average expenditure of about ten million dollars per year.

COST.

The cost of the canal is estimated at $99,689,000 if the route via Ste. Anne de Bellevue, Lake St. Louis and the St. Lawrence River is followed to Montreal. If, however, the other mouth of the Ottawa River known as Riviere des Prairies is followed, the cost is estimated at $93,890,000. In either case $900,000 will have to be spent for a feeder at the summit of the canal, when this is required.

The land damages are partly covered by the estimate and partly by contingencies. In most cases of undeveloped water powers it has been assumed that owners could be compensated by being granted power privileges at the nearest dam. The cost of damages cannot, however, be well defined. In ten years from now it is likely that the damages to pay would be much larger, as conditions on the river would be much more involved. This amount cannot be well foreseen. It might be larger than estimated by one or two millions, according to conditions at the time of construction and the leg[illegible]view taken of some of the claims.

The geology of the lower 200 miles of the [illegible]wa River creates seven main steps, at each one of [illegible]ich one or more locks are required. The estimated [illegible] of the Montreal reach from the Custom House to [illegible]tion is $3,859,000, including the lock, costing $1,090,[illegible] posite the Custom House near the Mackay pl[illegible]he Lake St. Louis reach from Verdun to Ste. Anne's [illegible]s- tance of 19 miles, is estimated at $12,553,000, [illegible] $1,093,000 is set down at Verdun to gain the [illegible] of Lake St. Louis. The impounded basin from [illegible] St. Charles westward afford an upper harbor five m[illegible] in length. The western part of Montreal above [illegible]ria Bridge would be protected from high water by t[illegible]ver- dun dyke. The new lock would have to be [illegible] at Ste. Anne, costing $784,800. The cost of the secti[illegible]om Ste. Anne to Port Fortune, 25 miles, is estima[illegible] at $2,334,000. Locks at Port Fortune and Hawa[illegible]ury furnish the means of rising over the Vaudreuil [illegible]dge from Oka Lake to the long reach below Ottawa, [illegible] dis- tance of 60 miles. The ten-mile stretch past the [illegible]long Sault Rapids would cost with the locks $3,860,880.

DOUBLE-DECK STEAM-TURBINE PLANTS.*

By J. R. BIBBINS,† M. Am. Soc. M. E.

The double-deck station strikingly departs from long-established practice. It is hoped to herein present some of the engineering features of this new type which deserve careful attention as standards for power sites of restricted area. The station at West Point, Ind., was designed to serve interurban railway lines through alternating-current substations, and its location is reasonably near the ultimate center of the system. It is but a short distance from some coal mines owned by the company, and the site chosen, at the foot of a hill, permits the use of the impounded waters of two passing streams for condensing purposes. With this site, coal-handling machinery was avoided and barometric condensers used, these several factors combining in the form of the double-deck arrangement. At the outset it will be well to review the most characteristic features of this station.

(1) Generating machinery above boilers on second floor.

(2) Weight of generating apparatus supported entirely by the steel building skeleton. All footings carried down to the same stratum—rock. Box columns 27 ft. high.

(3) Floor structure continuous, tied in from wall to wall, thus reinforcing over entire structure.

(4) Water-cooled floor column passing through the middle of the boiler setting to reduce weight and cost of beams spanning the battery; all other columns straddle boiler setting.

(5) Barometric condenser hung from the floor girders directly under the turbine exhaust nozzle. Designed for moderate vacuum; no air pumps; adjustable cones; centrifugal type circulating pump.

(6) Steam piping simple, with few bends, draining back from turbine throttle; no superheat; separators in each supply line to turbines.

(7) All important steam-header and supply lines controlled by pedestal extension valves from the turbine floor; non-return valves in the delivery from each boiler to prevent back-flow.

(8) Header serves largely as equalizer, hence small size (8-in.); sectioned by valves; operates practically on the unit system.

(9) Designed for 200-lb. pressure, high steam velocities; largest steam pipe in plant is 8-in., hung from girders.

(10) All auxiliaries steam-driven for feed heating; open type heater; feed taken from condenser hot well.

(11) Circulating pumps interconnected for relay working; primed by steam syphons or service pump.

(12) Pump suctions submerged 8 ft. in intake bay to avoid surface air; no foot-valves.

(13) Two-story side addition accommodating transformers; control and protective apparatus above; heaters and auxiliaries below; also serves as transmission tower.

(14) Operating switchboard located in division wall, leaving a clear rectangular operating room, and separate switch room.

(15) Generators air-cooled by positive blast piped from outside to reach cooler air and to avoid the possibility of steam from boiler room reaching insulation.

(16) Turbine bedplate leveled on plate girders throughout its length with cast lead pad 1 in. thick.

(17) Reserve exciter unit, steam-driven, exhaust to heater.

(18) Transformers mounted on trucks to facilitate replacement by reserve unit provided.

*A summary of a paper presented before the convention of the American Institute of Electrical Engineers, Atlantic City, June 29-July 2, 1908.

†Mechanical Engineer, Westinghouse Machine Co., East Pittsburg, Pa.

(g) Ash hoist to be installed from level of ash tunnel to level of siding track.

(h) Crane reaches basement through removable section of flooring.

(i) Flue connections direct to stack; no bends.

(j) Self-supporting, brick lined, steel stack.

(k) Elevated tank in turbine room to provide head for gland water and building service.

The West Point station covers a floor area of 2 sq. ft. per KW. capacity. The unusual construction has been used of a row of columns, supporting the floor, and coming in the division walls of the boiler settings. This materially reduces the span above. Such columns must, of course, be cooled and air spaces have been provided on both sides next the furnaces. In addition, cold water passes from the top to the bottom with the result that these particular columns are the coolest in the structure.

CONDENSERS.—The West Point station is an excellent example of the possibilities of a compact condensing plant. The barometric condensers are attached directly to the turbine exhaust. Here the condensers are arranged in line with the boiler fronts, but with a passage of over 6 ft. between boiler settings, it is quite evident that the condenser may be placed wherever most convenient, irrespective of the position of the batteries, and with a discharge tunnel conveniently located.

The suspension at West Point permits of an atmospheric relief connection between the supporting girders, resulting in a distance of only about 2.5 ft. from the floor level to the condenser head. Here the barometric condenser and horizontal turbine are evidently at their best advantage, both as regards compactness and efficiency. The high-speed centrifugal pump for condenser injection works well into the scheme at West Point, and with syphon or other means for priming is admirably adapted to the moderate head to be pumped against. Moreover it is considerably more compact and delivers a constant injection.

In the discussion of this paper before the Convention, Mr. C. W. Ricker, of Cleveland, gave the following table of cost, per KW. capacity on a basis of 3,000 KW. In considering these figures it should be remembered that cement and sand had to be hauled over mountain roads. On this account the steel work also cost $1.00 per ton extra.

COST PER KILOWATT CAPACITY. WEST POINT PLANT.

Buildings and all concrete work, coal trestle, etc.	$21.40
Boiler plant, including settings, pumps, pipes, pipe coverings	14.24
Barometric condensing plant	6.41
Turbine generating plant	37.59
General, miscellaneous, supervision erection, etc.	2.42
	$82.06

NOTES FROM ENGINEERING SCHOOLS.

UNIVERSITY OF MINNESOTA.—It is reported that the University of Minnesota will lengthen its engineering courses to five years. Some of the added time will be devoted to technical subjects, but the most of the gain will be given up to general culture subjects such as modern languages and economics. The degree of B. S. will be given at the end of the fourth year and the engineering degree will be conferred at the close of the fifth year.

THE COST OF CANAL WORK on the Lower Yellowstone Project, U. S. Reclamation Service, has been summarized by the Service as shown in the accompanying table. The cost to the contractor, given in the next to the last column, includes interest on investment, preparatory expenses, plant depreciation, and all labor and material chargeable to the work. For the three contracts Nos. 82, 167 and 198, the charges for executive control are also given. The cost to the United States, as shown by the last column, includes the bid of the contractor, engineering charges, and the cost of cement and reinforcing steel for concrete. Contract 49 extended over the three years 1905-06-07; 82, 1906-07; 167, 198 and 211 were carried out in 1907. The men were paid $2.50 and $2.75, and each team, including driver, $5 and $5.50 per day of nine and ten hours, respectively.

COST OF CANAL WORK ON FIVE CONTRACTS, LOWER YELLOWSTONE PROJECT, U. S. RECLAMATION SERVICE.

Item.	Feature.	Spec. No.	Contr. No.	Total quantity.	Price bid.	Unit cost to contractor.	Unit cost to U. S.
Excavation, Class 1c	Lateral N. Div. 7	60	82	44,399 cu. yds.	$0.15	$0.173	$0.176
Excavation, Class 1	Laterals	121	167	45,116 cu. yds.	0.25	0.183	0.267
Excavation, Class 1	Waste ditches	121	167	46,796 cu. yds.	.30	.178	.317
Excavation, Class 1b	Culvert drains, Div. 5, 6, Sch. C, D, E, F, H	Informal	198	20,599 cu. yds.	.23	.095	.231
Excavation, Class 1	Culvert drains, Sch. K	Informal	198	3,642 cu. yds.	.25	.101	.253
Excavation, Class 1	Div. 4, Schedule B	31	49	25,829 cu. yds.	.25	.337	.297
Earth embankment (canal)	Nelson Slough Dam	Informal	211	4,469 cu. yds.	.33	.187	.34
Earth embankment (dam)	Nelson Slough Dam	Informal	211	4,950 cu. yds.	.33	.20	.34
Excavation, Class 3	Div. 4, Schedule B	31	49	65 cu. yds.	.50	1.72	.76
Overhaul	Nelson Slough Dam	Informal	211	3,086 cu. yds.	.03	.017	.031
Rockfill	Nelson Slough Dam	Informal	211	33 cu. yds.	3.00	1.81	3.09
Backfilling	Div. 4, Schedule B	31	49	5,319 cu. yds.	.55	.256	.58
Concrete, Class 1	Div. 4, Schedule B	31	49	2,407 cu. yds.	6.25	7.80	10.65
Concrete, Class 2	Div. 4, Schedule B	31	49	136 cu. yds.	5.75	7.05	9.87
Placing reinforcing steel	Div. 4, Schedule B	31	49	187,929 lbs.	.01	.007	.03c
Structural steel in place	Div. 4, Schedule B	31	49	14,146 lbs.	.08	.094	.063
Cast-iron in place	Div. 4, Schedule B	31	49	1,642 lbs.	.07	.102	.084
Lumber in place	Div. 4, Schedule B	31	49	4,980 ft. B.M.	45.00	82.25	54.41
Riprap	Div. 4, Schedule B	31	49	1,056 cu. yds.	2.00	2.58	2.36

a Includes overhaul 1,455 cu. yds. 100 ft. for which $29.10 was paid, but no separate record kept for contractor's expense therefor.

b 129 cu. yds. wet excavation included for which $1.00 per cu. yd. was paid, but no separate record of cost to contractor kept.

c Includes cost of steel also.

COMPARATIVE DATA OF THE ASSUAN, ROOSEVELT, SHOSHONE AND PATHFINDER DAMS.

Elements.	Assuan.	Roosevelt.	Shoshone.	Pathfinder.
Length, ft.	6,562	1,080	175	226
Maximum height, ft.	141	284	326	215
Maximum water depth, ft.	107	242	243	195
Crest width, ft.	30	16	10	10
Down-stream batter	3:2	3:2	4:1	4:1
Up-stream batter	18:1	20:1	20:3	20:3
Volume, cu. yds.	790,000	340,000	69,000	53,000
Gates	140-6½′ × 23′ 40-6½ × 11½	3-4½ × 10′	3-3′2″ × 7′	4-3′2″ × 7′
Storage, acre-ft.	1,800,000	1,284,000	456,000	1,025,000
Material*	Granite	Sandstone	Concrete	Granite

*Rubble masonry for all except the Shoshone Dam, which is of concrete masonry.

AN EXPLOSIVE WITH LOW FREEZING POINT has been put upon the market by the E. I. du Pont de Nemours Powder Co. under the name "Red Cross Dynamite." The manufacturers claim that by the use of ingredients which in no way detract from the strength of the explosive, the freezing point of the nitroglycerin is lowered to 35° F.; moreover when the temperature continues to sink still lower, the Red Cross dynamite freezes with extreme slowness. When frozen it can be thawed with a small fraction of the time and expense experienced with ordinary dynamites. It is manufactured in strengths from 25% to 60% according to both the straight and ammonia dynamite formulas.

USE OF CEMENT IN THE CANAL ZONE.—During the past four years, contracts have been placed for 185,150 bbls. of cement for use on canal work, and all but about 200 bbls. of this was delivered in barrels. The loss by broken packages and deterioration during shipment has been about 3% for cement shipped in bags and about 0.1% for that shipped in barrels. Delivery has been made in small quantities, and it is seldom that the cement is allowed to stay long in storage, so urgent is the demand for it. On this account little is known of the effect of the moist atmosphere on the cement, although it has been determined by test made by the Division of Building Construction that it suffers little or no deterioration on account of the sea voyage.

Masonry work in the Zone is practically confined to reinforced concrete and concrete blocks, on account of the cost of importing bricks and the limited amount of building stone to be found here. It is estimated that the cost of the Administration Building at Ancon, which is a large three-story structure of concrete blocks, was about half what it would have cost if made of stone or brick. Two large magazines for the storage of explosives are to be built of concrete blocks, and several powder houses have been constructed of this material. Tests recently made by firing steel-pointed bullets from a rifle at close range against several blocks show that they are absolutely bullet-proof, as in no case was even the outer wall penetrated or shattered.

A plant for making concrete blocks was installed at Ancon in 1905, and has been maintained with a constant increase in effectiveness and decrease in the cost of its manufactured product. In the 11 months, ending May 31, this plant made 17,969 blocks, at a cost of 12½ cts. a cu. ft. They were used in building eight powder and detonator houses, three fire walls, one driveway, and eight office vaults. The mixture is 1 part cement, 3 parts sand, and 3 parts stone chips. When three months old, blocks made of this mixture have shown a tensile strength of 342 lbs.—"Canal Record," July 1.

COMPARATIVE DATA OF THE ASSUAN, ROOSEVELT, Shoshone and Pathfinder Dams have been prepared by the U. S. Reclamation Service as shown in the accompanying table. The Assuan Dam is located on the Nile in Egypt at the First Cataract, some 590 miles above Cairo. It is now being raised from its original maximum height, 118 ft., to a proposed height of 141 ft., for the purpose of storing additional water for irrigation. The other three dams listed in the table are well-known structures now being built by the U. S. Reclamation Service.

FLOODS IN NEBRASKA, as reported from Lincoln, July 7, drowned 25 persons, while over two thousand refugees from the lowlands were being sheltered in the higher lying towns.

THE BREAK IN THE CORNWALL, ONT., CANAL was finally repaired on July 10 and navigation resumed the same day, just 17 days after the break. A description of the collapse of the canal walls and the consequent repairs was given in our issue of July 9, 1908, p. 34.

AN EXPLOSION ON THE TANK SHIP "SHENANGO," a three-master, 298 ft. in length, as she lay in drydock at Philadelphia, Pa., July 4, killed two men and seriously injured two others. The "Shenango" is regularly employed in bringing oil in bulk from Texas to Philadelphia and it is thought that as the vessel was full of gas from her recently discharged cargo, this must have become ignited.

A BOILER EXPLOSION wrecked the water-works at Monongahela, Pa., July 7. The engineer had presumably allowed the water in Boiler No. 3 to run too low during the noon hour. He had just returned from lunch and was heard to blow off steam several times, when the accident followed. He was buried under the debris and his body has not, at last reports, been recovered. Some dwellings near the plant were also severely damaged.

AN EXTENSIVE PIER FIRE in Boston Harbor on July 9 caused the death of a watchman and did damage to an amount between one and two million dollars. The fire started in the outshore end of a passenger and freight pier of the Cunard Line, in East Boston, supposedly from spontaneous combustion. The 800-ft. pier with its steel pier-shed, and two piers adjoining to the east, a freight pier of the Boston & Albany R. R. and the pier of the Leyland Line, with a grain elevator on the middle pier, were destroyed. The direction of the wind fortunately was such as to keep the fire from extending to the town of East Boston. Lack of water on the land side is charged with much of the blame for the large extent of the fire.

IN A MINE GAS EXPLOSION July 1, at the No. 9 mine, property of the Mexican Coal & Coke Co., at Las Esperanzas, Coahuila, Mexico, 18 men were killed, several injured, and six are still missing. The gang, all Mexicans, with the exception of one Japanese, were leaving the works on board the mine cars when the explosion occurred and all were thrown off the cars and against the slope.

A SERIOUS BRIDGE ACCIDENT IN GERMANY on July 9 killed 15 to 20 bridge erectors. The bridge is at Cologne, and crosses the Rhine. The falsework of one of the main spans broke down, carrying with it some of the adjoining work. The men killed were at work on the scaffolding. Apparently the structure in question is one of a set of three bridges which are to replace an old combined highway and railway lattice bridge. Four railway tracks and a highway are to be provided for, and for this purpose there will be three bridges close together, one of them being on the site of the existing bridge. The main span is to be nearly 500 ft. in length. The construction of the new work will occupy four or five years, traffic being maintained at all times. The piers were begun last year, and during the present season the erection of the steelwork of the northerly bridge was to be started.

A RAIN STORM which broke with great violence over New York City late in the afternoon of July 14 demonstrated the imperfect protection still afforded electric

power apparatus from the effects of lightning. A discharge is reported to have entered the overhead system of the alternating-current traction installation of the New York, New Haven & Hartford R. R. and so disabled the line and power-house that the traffic on this road out of New York City was completely blocked until steam locomotives could be pressed into service. It will be remembered that no steam traction has been used on this road betwen Grand Central Station and the suburbs for several weeks and the reversion to steam under stress of this disablement was but slowly accomplished. The electric system was in working shape, however, after several hours' work. The third-rail electric system of the New York Central R. R. was not affected by the lightning. On account of the suddenness of the downpour, the storm sewers at Sixth Ave. and Ninth St., New York City, failed to clear the streets of water and it poured into an opening made at that point for building a station on the Hudson River tunnel to New Jersey. It is reported that the water rose some 8 ins. above the third rail in the tunnel between Sixth and Fourteenth Sts. In this part, the tunnel drains away from the river section and shuttle trains were maintained between Hoboken, N. J., and Christopher St. station, New York City. The flooded portion of the tracks was pumped out a few hours after the storm.

PANAMA CANAL EXCAVATION maintained a satisfactory progress during the month of June. The total excavation was 3,056,956 cu. yds. for 26 working days, a daily average of 117,576 cu. yds., as against the maximum excavation of 3,487,287 cu. yds. in the month of March, 1908, a daily average of 133,857 cu. yds. for 26 working days. The rainfall during June was 9.99 ins., a decrease from the May total of 14.64 ins. The detail figures for June and May in cubic yards place measurement are as follows:

	June.	May.
Culebra Division	1,099,068	930,179
Gatun Locks	116,998	138,815
Chagres Division, Mindi, Miraflores Locks, Pedro Miguel Locks and Cardenas	444,320	362,404
Colon Division	572,749	564,386
La Boca Division	656,621	530,466
Total Canal prism	2,889,756	2,526,250
Accessory works outside Canal prism (by steam shovels)	167,220	177,673
Total Excavation	3,056,976	2,703,923

THE 909-FT. BUILDING for the Equitable Life Assurance Co., plans for which were submitted recently to the New York City Building Department, as noted in our issue of July 2, will not be built immediately. It is reported at the office of the company in New York that the plans as submitted are for some future construction, but that no time has been set for the starting of the work. It has been rumored that the design, involving some 70 drawings and costing many thousands of dollars, was prepared so prematurely in order to get the approval of the building department before the possible enactment of a law prohibiting so great a height in buildings. It would seem, however, that such a law, if passed, would be effective in prohibiting the erection of buildings of excessive height for which departmental permission had been granted, provided actual construction had not been started.

THE CUNARD LINER "LUSITANIA," by her westward voyage, completed July 11, achieved the distinction of being the first 25-knot steamer. She covered the long course from Daunt's Rock to Sandy Hook, of 3,891 miles, in 4 days, 19 hrs., 36 mins., an average speed of 25.01 knots per hour. A new record for the longest day's run was also made, 643 knots having been covered during the first day of the voyage.

A readjustment of her propellers, which was made in Liverpool, is considered to have aided the ship to attain this speed. Two new forward propellers of four blades replaced the former three-bladed ones. They are solid castings of manganese bronze. The two rear propellers remain as before, with three blades. It is said that this arrangement also did away with all vibration.

SIDE-DOOR CARS are to be tried in the New York subway to determine their value in accelerating the interchange of passengers at stations. A recent report of Mr. B. J. Arnold to the Public Service Commission (Eng. News, 1908) recommended cars with two side doors at either end on both sides, eight doors per car. At subsequent hearings before the Commission the Interborough Rapid Transit Co. strongly opposed this recommendation. Mr. Frank Hedley, General Manager of the company, declared that side-door cars have proved a failure wherever tried and that they would cut down the traffic capacity rather than increase it. The expense of changing all the cars on the system would amount to nearly $2,000,000. On July 10 the Commission formally ordered the company to equip 16 cars with side doors as recommended. These cars are to be put in service by Oct. 15, and operated in two trains of eight cars during rush hours. These cars are also ordered to be fitted with automatic door-closure signals. The working of these trial cars will be the basis of the Commission's further action in the matter.

A 28-MILE CUT-OFF on the main line of the Delaware, Lackawanna & Western R. R. has just been put under contract. The new track will extend from near Lake Hopatcong in Morris County, N. J., to Andover in Sussex County, and thence through Warren County and across the Delaware River to Slateford, Pa. There will be no tunnels nor grade crossings. The cut-off will effect a great reduction in curvature and grades. The present line has a maximum grade of 60 ft. to the mile, while that of the cut-off will not exceed 29 ft. The total saving in curvature will amount to 1,560°. The principal feature will be an embankment 2½ miles long with an average height of 90 ft. This embankment will contain 6,625,000 cu. yds. of material and is claimed to be the largest railway embankment ever made. A cut requiring the excavation of 541,000 cu. yds. of solid rock will be made near Andover. This cut will be nearly ½-mile long and will attain a depth of 132 ft. The new route will require a total of 13,000,000 cu. yds. of embankment and 13,154,500 cu. yds. of excavation, of which 4,293,500 cu. yds. is rock. Although only eleven miles shorter than the present line, the cut-off is expected to reduce the running time of passenger trains half an hour, through the more favorable grades and better alinement.

MECHANICAL REPAIRING UNDER DIFFICULTIES is instanced by the "Mining and Scientific Press" of July 4, with the following inspiring example:

A party of mining men went 140 miles north of Tonopah across the sage-brush plain in an automobile. The car hit a projecting rock, hidden in the brush; the front axle was bent almost double and a hole was torn in the crank-shaft case. These up-to-date explorers made a fire with sagebrush and straightened the axle by hammering it while hot with stones. The hole in the crank-shaft case was repaired with a piece of rubber, a part of a gunny-sack, the fragment of a coal-oil can, all of which was bound with bailing wire. They made their return serenely. If they had not been able to make these repairs, their plight would have been serious indeed.

OIL FUEL will be used on ten torpedo boat destroyers whose construction was authorized by the last Congress. However, facilities for using coal will also be installed as a reserve in case the oil burning system should fail. These destroyers are to have a displacement of 700 tons with a length of 289 ft., 26-ft. beam and 8-ft. draft. The contract speed called for is 28 knots. Five of the vessels are being equipped with turbine engines.

PERSONALS.

Mr. J. G. Gwyn, Assistant Chief Engineer of the Denver & Rio Grande R. R., has been appointed Chief Engineer, with headquarters at Denver, Colo.

Mr. F. F. Prendergast, Assistant Engineer on the Shoshone Project of the U. S. Reclamation Service in Wyoming, has, after four years' work in the service, resigned to engage in private work.

Mr. Douglas W. Ross, M. Am. Soc. C. E., after five years' service in the work of the U. S. Reclamation Service, resigned as Supervising Engineer, June 30. Mr. W. H. Sanders, M. Am. Soc. C. E., Consulting Engineer, U. S. Reclamation Service, has been appointed to fill the vacancy.

Messrs. James N. Hazlehurst, M. Am. Soc. C. E., and Charles L. Anderson, Assoc. M. Am. Soc. C. E., announce an association as Hazlehurst & Anderson, for the practice of their profession as consulting municipal engineers. Their offices are in the Candler Building, Atlanta, Ga.

Mr. W. R. McKeen has resigned as superintendent of motive power and machinery of the Union Pacific R. R. to assume management of the McKeen Motor Car Shops which will be established in Omaha, Neb. Mr. B. F. Fuller, who has been assistant to Mr. McKeen, succeeds him.

Mr. J. W. Richardson, who for the past two years has been engineer in charge of the building of terminals at Jacksonville, Fla., for the Atlantic & East Coast Terminal Co., has completed this work, and has been appointed Chief Engineer of the Vera Cruz Terminal Co., Vera Cruz, Mexico.

Mr. A. H. Horton, Assoc. M. Am. Soc. C. E., Assistant Engineer U. S. Geological Survey, formerly connected with the Washington office, has been assigned to take charge of the newly established stream-gagings district which comprises the Ohio River Valley and adjacent areas. His headquarters will be at Newport, Ky.

Mr. Geo. E. Goodwin, Assoc. M. Am. Soc. C. E., formerly construction engineer on the Huntley Project, U. S. Reclamation Service, at Huntley, Mont., has been designated to take charge of the reclamation work for the Indian Service, on the Blackfeet Two Medicine Project. His headquarters will be at Browning, Mont.

Major James P. Jervey, Corps of Engineers, U. S. A., has been relieved from duty at Pine Camp, Jefferson Co., N. Y., and will proceed at once to Washington Barracks, D. C., for temporary duty. He will then go to the Isthmus of Panama and report to Lieut.-Col. Goethals, Chairman of the Isthmian Canal Commission, for duty.

Mr. E. F. Tabor, M. Am. Soc. C. E., formerly engineer on the U. S. Reclamation Service project at Shoshone, Wyo., has been appointed Project Engineer in charge of the Flathead Indian Project, with headquarters at St. Ignatius, Mont. The work here is approaching completion. The engineering force as reorganized includes A. J. Fisk, Jr., C. E. Hewitt and F. Towle, assistant engineers.

Lieut.-Col. Solomon W. Roessler, engineer officer at Portland, Ore., will take charge of the New York engineer district, succeeding Gen. Wm. L. Marshall, the new Chief of Engineers. Col. Roessler will supervise all the river and harbor improvement work about New York City excepting the new Ambrose Channel in New York Bay of whose completion Gen. Marshall will remain in charge.

Obituary.

William T. Stewart, formerly active as a mechanical and civil engineer in Pittsburg, Pa., died July 7 at the age of 70 years, at his home in Pittsburg. He had retired from the practice of his profession about 20 years ago. Mr. Stewart is survived by his wife, three sons and nine daughters.

Nicholas J. Kelly, Superintendent of the Lake Erie & Depew Water Co., and formerly Chief Engineer of the Buffalo General Electric Co., died at his home in Buffalo, N. Y., on July 8. His death resulted from injuries sustained about two months ago when he was thrown from his buggy by the breaking of a wheel. Mr. Kelly was born in Ireland in 1861 and came to Buffalo when he was 22 years old. Under Mayor Diehl's administration he was a member of the City Civil Service Commission.

ENGINEERING SOCIETIES.

COMING MEETINGS.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.
July 24-25. Summer meeting at Niagara Falls, N. Y. Secy., W. M. Mackay, P. O. Box 1818, New York City.

NEW ENGLAND WATER-WORKS ASSOCIATION.
Sept. 23-25. Annual convention at Atlantic City, N. J. Secy., Willard Kent, 715 Tremont Temple, Boston, Mass.

ILLUMINATING ENGINEERING SOCIETY.
Oct. 6-7. Annual convention at Philadelphia, Pa. Secy., Van Rensselaer Lansingh, Engineering Societies Building, 33 W. 39th St., New York City.

AMERICAN ELECTROCHEMICAL SOCIETY.
Oct. 30-31. Fall meeting at New York City. Secy., Dr. J. W. Richards, Bethlehem, Pa.

AMERICAN PUBLIC WORKS ASSOCIATION.—A meeting of this association will be held Sept. 29-30, at Asheville, N. C. Papers on timely subjects will be presented.

AMERICAN STREET AND INTERURBAN RAILWAY MANUFACTURERS' ASSOCIATION.—The twenty-seventh annual convention will be held at Atlantic City, N. J., Oct. 12-16. Young's Million Dollar Pier has been secured by the association for exhibition purposes. Official headquarters will be at the Marlborough-Blenheim Hotel.

INDIANA SANITARY AND WATER SUPPLY ASSOCIATION.—A "Conference of Municipal and Private Owned Water Plants of Indiana with the State Board of Health" was held at Indianapolis, on July 8 and 9, under the auspices of the board named. It resulted in the formation of an association, as named at the head of this paragraph.

The object of the conference was "to study the sources of water supplies in Indiana, their preservation and purification; and to establish standard and uniform methods of analysis." Ten papers on various phases of the subjects indicated were presented, mostly by Indiana men. Among outsiders, Mr. M. O. Leighton, Chief Hydrographer of the U. S. Geological Survey, called attention to the marked lowering of the ground-water level in parts of the State, and urged conservation of the supply; Mr. Geo. W. Fuller, of New York, discussed the management of purification works; and F. W. Witherell, of Pittsburg, Pa., took up filtration plants for small cities. Mr. F. A. W. Davis, of Indianapolis, and several others, made strong pleas against stream pollution. Particular stress was laid by Prof. R. L. Sackett, of Purdue University, on the need for diverting crude sewage and manufacturing wastes from the White River, which is the source of the water supply of Indianapolis and a number of other cities. Mr. Dow R. Gwinn, of Terre Haute, presented a system of bookkeeping. A public utilities commission was urged by Mr. A. H. Kennedy, of Rockport.

The officers of the new association include the following: President, H. E. Barnard, State Pure Food Commissioner; First Vice-President, Dow R. Gwinn, Terre Haute; Secretary, Frank Jordan, Indianapolis; Treasurer, Geo. A. Fletcher, Brazil.

ENGINEERING LITERATURE

Supplement to ENGINEERING NEWS. 220 Broadway, New York, July 16, 1908.

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REVIEWS.

Steel Railway Bridges.

Reviewed by ALBERT WELLS BUEL*

THE DESIGN OF TYPICAL STEEL RAILWAY BRIDGES.—An Elementary Course for Engineering Students and Draftsmen. By W. Chase Thomson, M. Can. Soc. C. E., Assistant Engineer Dominion Bridge Co., Ltd., Montreal, Can., Author of "Bridge and Structural Design." New York: The Engineering News Publishing Co. London, England: Archibald Constable & Co., Ltd. Cloth; 6 x 9¼ ins.; pp. 178; 21 illustrations, partly in the text. $2, net.

For some years past the larger bridge companies have provided series of lectures for their drafting-room apprentices. The volume before us has been developed from such a series of lectures. It is a sequel to "Bridge and Structural Design" by the same author, which was developed in the same way.

The two volumes form an excellent basis from which an instructor can present the subject treated to a class, but put in the hands of the student or beginner, who lacks experience for discrimination, and without an instructor to point out the relative value of the details presented, they are liable to convey some impressions that can hardly be called either good or typical.

The present volume is devoted chiefly to the presentation of six examples in design of steel superstructures. An introduction gives the necessary extracts from a specification, with some annotations, tables and a moment diagram; and there is a final chapter on latticing of compression members. The examples are selected with good judgment and cover the range of average railway bridge superstructures in a way that may be called typical. The specifications given are extracts from the Dominion Government specifications of 1901, and this fact, to some extent, detracts from the value of the work for use outside of Canada. Each of the six examples given might have been worked out under a different specification, selecting those in most general use. This, in addition to increasing the practical value of the work, would have afforded an excellent opportunity to present some instructive comparisons of specifications. But, on the other hand, the differences in specifications are more apparent than real and are not so great as to materially change the work of an example.

The method of presenting the examples, and also the detailed work included, as well as that excluded, leave little to be desired. The reviewer does not know of any other work covering the same ground, and this book should prove of inestimable assistance to every beginner in structural steel design. With it the time required by the average man to become proficient should be cut in half.

A few minor points on which opinions differ are worth mentioning.

Under the heading "impact" no mention is made of the effect of unbalanced parts of locomotives and impact is added for centrifugal force in the same ratio as for vertical live load. The author's reasoning on impact formulas is correct and in accord with recent practice, but he overlooks the fact that several specifications now use an impact formula transposed from the old Launhardt (or Cain-Launhardt) formula, which is similar in all essentials to the one he adopts and which, in the opinion of some engineers, has advantages of its own. At least it avoids squaring the live load.

The term "factor of safety" is one that ought to have been discarded long ago.

The author's views on column formulas can hardly be taken as representative on this side of the border. Within the practical range of the ratio, l divided by r, the straight-line formula is just as correct as the Rankine formula, as was shown by Mr. Thos. H. Johnson, in a paper on column formula (Trans. Am. Soc. C. E., No. 337, Vol. XV., July, 1886).

The author fails to mention the danger of secondary stresses in struts with riveted connections, while arguing that they are stiffer than hinged struts. The square-ended posts in the testing machine are under quite different conditions from the posts in a riveted truss.

The maximum depth of plate girders is fixed at one-tenth the span, which is hardly enough for economy under present-day heavy loadings. The minimum depth of one-twentieth the span will give rather large deflections unless otherwise provided for.

Stringers are required to be braced when their length exceeds 15 times the width of flange, but otherwise no bracing is required when track is on a curve.

While the author's estimate of the comparative merits of the Moment Diagram and Moment Tables is doubtless correct, two additional pages devoted to the latter method would have perhaps made the work more generally useful. Many still use and prefer the tables, and their practice should be considered.

The notation used is liable to cause some confusion. For instance, w = weight of metal on page 17 and w = dead load on page 18.

Determining the length of girder flange plates by the graphical method takes too long, when one set of the slide rule gives the length of all the flange plates directly.

The treatment of the web splice of plate girders is quite different from that of the earlier book by this author, and many designers will consider it a step backward.

Those who have had considerable to do with maintenance work will generally disapprove of the omission of bottom laterals in deck plate girders.

Referring to the top lateral frame of the deck plate girder, it is stated that "the diagonals support one another at the center, so that their half length may be used in figuring their capacity" (as compression members). The angles used have equal legs, 3 x 3 ins. They support one another in the horizontal plane, but not in the vertical plane. The End Brace Frame is lighter than is generally used on first-class work.

The weight of the floor for the Deck Warren Girder is assumed, whereas it should have been computed.

The Dead Load formula used is indiscriminately applied to Deck Plate and Deck Warren Girders and Through Pratt Trusses, etc., whereas it is a Deck Plate formula. A table of actual weights would add to the value of data given and several dead-load formulas might have been added to advantage.

The designs of Top Chord sections used have excessive eccentricity, which, while not so important in riveted as in pin-connected trusses, does not give the most economical section.

It is not clear why the top chords of riveted Warren trusses should not be spliced at panel points, to take full advantage of the panel point gusset plates.

The method adopted for fixing the thickness of the webs of chords and of gusset plates involves the use of objectionably thin fillers.

It is refreshing to see estimates worked out to the nearest ten pounds for each item. It is far within the limit of error and saves the time of adding up one column.

The design illustrated in Chapter V. is not typical for spans of "175 ft. to 275 ft." in the United States, where they would be pin connected. A sub-panel web system would be more economical. It is to be regretted that the author has not used the moment method for finding the stresses in curved chord trusses and trestle bents, at least as an alternate to the graphical method.

In the last chapter is given Prof. C. T. Morris' method for designing the latticing of Compression Members, in its modified form. This is the first time this question has been satisfactorily handled in a text-book.

Notwithstanding these shortcomings, which are mostly non-essentials (and it must be stated that lack of space prevents any attempt at mentioning all the good points) the book is a commendable effort to fill a long-felt want. It should be in the possession of all the younger men engaged in structural steel work, and many older ones will find it useful.

The paper, typographical work, cuts and plates are about the best that have yet appeared in a book of this class.

*Engineer in charge of structural design in the office of Virgil G. Bogue, Civil Engineer, 15 William St., New York.

THE PRINCIPAL SPECIES OF WOOD.—Their Characteristic Properties. By Charles Henry Snow, Sc. D., M. Am. Soc. C. E., Dean of the School of Applied Science, New York University. Second Edition, revised and enlarged. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 6½ x 10¼ ins.; pp. 212; numerous plates and text illustrations. $3.50.

In its present revised and enlarged form the usefulness of Professor Snow's unique book is materially increased. The first edition was noted briefly and favorably in our issue of May 14, 1903, but for the convenience of our readers we give some idea of the scope of the book by quoting from the Preface:

The following is a brief untechnical presentation of general features characterizing economically important species of wood. It is the result of notes originally brought together from many already existing sources and later augmented, and verified so far as possible for the present use, by personal observation. The work of preparation has not been as simple as the result would indicate, and although great care has been taken to check each fact, errors do no doubt exist, although it is not believed that there are important ones.

Engineers while writing upon woods have, save exceptionally, emphasized strength beyond most other properties. Other works for expert foresters or botanists are of necessity too special, voluminous, fragmental, or technical for the casual student. Some popular books on trees, as distinct from woods, are available. The present form is distinct from these and is intended for those who are not foresters or botanists, but who use woods or desire knowledge of their distinguishing properties. Allusions to trees, historical and other references, aside from those directly regarding woods, are made for completeness and in order to mark, distinguish or separate the species.

Of the present edition Professor Snow states that corrections have been made in the original text, that some sections have been rewritten, and that over four hundred new names have been added to the index.

The Theory of the Francis Turbine.

Reviewed by S. J. ZOWSKI.*

ZUR THEORIE DER FRANCIS-TURBINEN.—With Tests on a 300-HP. Turbine. By Fritz Oesterlen. Berlin, Germany: Julius Springer. Paper; 6¼ × 9¼ ins.; pp. 106; 19 plates and 31 text illustrations. 7 marks; American price, $2.80.

Turbines are always designed for a "shockless entrance" at normal head and load, but normal conditions seldom occur in practice. Most of the time the turbine is working with more or less shock, thus with an efficiency which is smaller than the "best" efficiency.

In the book before us Mr. Oesterlen develops the laws of the variation of the efficiency with varying entrance conditions and derives formulas to determine the same. Since investigations of this nature involve questions of hydrodynamics that still are more or less obscure, some assumptions had to be made. Assumptions naturally limit the preciseness of a theory, and for this reason Mr. Oesterlen's book is to be considered especially valuable, because the author conscientiously tests his theory by experiments made on a commercial turbine.

After an introduction in which the notation, used in the book is explained the author derives in the first chapter the known main turbine equations, valid for shockless entrance, following in general Zeuner's methods. Thus the equation for the moment and work of reaction, the balance equation and a convenient discharge formula are derived.

At the beginning of the second chapter the shock of a stream of water in stationary and moving, open and closed channels is studied, and the uncertainty in regard to the assumption, that the entire shock component represents lost energy, is removed. Then the equations for the entire moment and work of reaction for the case of an entrance with shock are derived and the main turbine equations, valid for any working conditions. Finally, the general balance, power, efficiency and discharge equations are found. Special formulas for the turbine torque and discharge when the turbine is stopped or added. After a discussion and interpretation of these formulas the author proceeds to prepare the ground for a rational examination of the same by the results of actual tests. With this purpose in view he analyzes in the third chapter the flow of the water through the runner.

With the complex forms of modern runners, especially those of high speed, the determination of the guide vane and bucket angles and the passage areas, which are the factors of the derived equations, is not simple. All speeds and diagrams have to be considered in the direction of the water-flow lines. These flaw lines in the modern runners of the so-called mixed-flow type are located on conical and ring surfaces. The generating curves of these surfaces vary in direction at each point of the entrance and discharge edge of the bucket. Since we are able to measure the guide vane and bucket angles and the passage areas only in plane and cylindrical surfaces, the actual values, which are the projections of the measured values on the tangents to the last elements of the flow lines, must be calculated from the measured values. Methods of finding these values are fully explained by the author.

Contrary to the opinion of several authors of recently published books on water turbines, Mr. Oesterlen regards as the entrance diameter of the runner the diameter of the circle going through the edges of the buckets—not that of the circle going through the centers of the entrance areas. His reasoning in this respect is quite plausible.

Because of the complex forms of the modern turbine runner we must subdivide the same for all accurate investigations into several "part runners" of heights small enough to allow for the assumption of constant diagrams, angles and areas. Each turbine part must be calculated separately and the results must be integrated properly to get the mean values for the whole runner. After the methods of this integration have been explained, the author proceeds in the fourth and last chapter to test his theory by the results that were obtained from tests made on a J. M. Voith turbine.

The runner is subdivided into six part runners. For each of these part runners the actual entrance diagram is calculated and designed corresponding to the speeds and discharges of the different tests. Then the efficiencies are found according to the given theory, and the mean values of these computed efficiencies are compared with those which have been found by test. All these computations are made for the 18 different working conditions under which the turbine was tested. All diagrams are designed to scale and all computations are tabulated.

The result of this examination is quite satisfactory. In 12 cases the error is smaller than 3%, in two cases smaller than 5%, in the remaining three cases larger, reaching 10%. But these three cases are those where the speed of the turbine was about 30% larger than the normal speed. For such increased speeds the pressure head, which is the characteristic of the pressure turbine, is diminished so much that the flow and its continuity must become uncertain. With this the basis for any theory fades away.

For a simplification of the computation and for a lack of sufficient experiments with the turbine draft-tube, the author had to make the assumption that all hydraulic losses inside of the turbine minus the gain in the draft-tube remain constant for each speed and load. This assumption, apparently, is not correct, and is the main reason why the error in the 12 cases amounts to 3%. Nevertheless, this percentage is so small that Mr. Oesterlen's theory can be adopted for practical calculations for all ranges of speed and load that usually occur, unless further experiments, embodying the study of the flow through the runner and draft-tube, will enable us to make the necessary corrections.

Mr. Oesterlen's book is one of the best studies of water turbines ever published. It will stimulate further research work in this direction for the benefit of science and practice.

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A Short General Treatise on Hydro-Electric Power Development.

DEVELOPMENT AND ELECTRICAL DISTRIBUTION OF WATER POWER.—By Lamar Lyndon. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 317; 158 illustrations in the text. $3, net; English price, 12s. 6d., net.

Mr. Lyndon's book possesses some features of novelty, and the work should be of particular interest to those engineers whose activities do not tend to give them knowledge and experience in the trend of hydraulic and electrical power developments. It seems to be the evident purpose of the book to reach such persons and there is little attempt made to make the volume a complete text on the design of dams, canals, flumes, pipe lines, hydraulic and electrical machinery, or of transmission lines. It rather presents in a sketchy and non-mathematical way the prominent and common lines of such hydraulic and electrical features as mentioned.

The author has pointed out the wisdom of studying back numbers of the various engineering journals to find what has been done up to date in these lines of work. To lessen the labor of such extended study as this Mr. Lyndon has selected descriptions of two foreign and seven American developments as typical of the results of such a study. These nine descriptions form nearly half the book. The particular installations are: (1) Power-house, transmission line and transformer stations of the Tofweholt-Westewik plant in Sweden; (2) the hydraulic development at West Buxton, Me.; (3) the dam, flume, pipe-line and power-house of the Animas Power and Water Co., Animas, Colorado; (4) the hydro-electric plant of the City of Drammen, Norway; (5) the hydro-electric construction at Great Falls on the Catawba River, South Carolina; (6) an 8,000-HP. development on West Canada Creek at Trenton Falls, N. Y.; (7) the hydraulic construction of the McCall Ferry Plant on the Susquehanna River; (8) the Taylor's Falls, Minn., t[ra]nsmission system with special regard to the [elec]trical equipment and the lightning protectio[n] the transmission line; (9) the Kern River st[a] No. 1 of the Los Angeles Edison Electric Co.

THE MANUAL OF STATISTICS.—Stock Exch[ange] Handbook, 1908. 30th Annual Issue. New [York]: The Manual of Statistics Co. Cloth; 5¼ × 8 [¼] ins.; pp. 1080; folding maps. $5.

This desk handbook gives concisely such d[ata] and statistics as are most frequently desired [by] the investor and stock speculator. The vol[ume] is divided into three parts: The first 300 pa[ges] are devoted to the railway companies of Ameri[ca] giving their location, frequently illustrated w[ith] good maps, their mileage, prime circumstances [of] construction and operation, organization, fin[an]cial status and date of annual meeting. T[he] major portion, over 500 pages, deals with indu[s]trial corporations according to the same plan [of] information; manufacturing, street railway, el[ec]trical, gas, mining, land, telegraph and misc[el]laneous companies are described by statement [of] facts bearing upon the investment value of the[ir] paper. The last part of the book lists govern[ment] securities, stocks, according to the main exchanges upon which they are dealt in, and gives the most important statistics of the cotton, produce and metal markets, of money and of this country's banking institutions. It will be found a handy compendium of the subjects treated.

THE SLIDE RULE POCKET MANUAL.—A Treatise on the Structural Slide Rule. By John L. Hall, Author of "Tables of Squares." New York: The Engineering News Publishing Co. Paper 5½ × 3¼ ins.; pp. 54; 4 folding plates and 11 text figures. 50 cts.

While a good half of this little book deals with the ordinary slide-rule, its chief purpose is to explain the working of the "Structural Slide-rule," invented by the author. This rule has three slides, arranged on the three faces of a 16-in. body of triangular cross-section, like the familiar three-edged scale but about twice as large. Of the three faces, one is just like the face of an ordinary slide-rule; the second has scales so graduated and marked as to solve the column formula $p = 15{,}200 - 58\ l/r$, for steel columns; the third face, equipped with a double slide, solves problems relating to the strength, span, spacing, load per square foot of floor, of beams, and for this purpose has its upper scale made up of a series of gage-points for all the commercial sizes and weights of I-beams and channels. In the sample sent us, unfortunately, the rule is so crudely made that it can hardly be considered a commercial article as yet.

WASHING AND COKING TESTS OF COAL AND CUPOLA TESTS OF COKE.—Conducted by the U. S. Fuel-Testing Plant at St. Louis, Mo., Jan. 1, 1905, to June 30, 1907. By Richard Moldenke, A. W. Belden and G. R. Delamater; with Introduction by J. A. Holmes, In Charge of Technologic Branch. Bulletin No. 336, U. S. Geological Survey, George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 76.

The tests on the washing and coking of coals and on the resultant coke in cupola practice, as described in this bulletin, were made at the St. Louis fuel testing laboratories in 1905 and 1906. The work was a part of a general plan to determine the most economical manners of utilizing the coals of the country.

The washing tests showed that it was possible to reduce the ash content of the slack 20 to 60% and to cut down the sulphur by 10 to 50%. The tests on coking of coals are so varied in results that each individual sample needs to be studied alone; a broad generalization of results seems impossible. The cupola tests yielded many data on melting ratio of coke to iron, rate of melting, iron recovered, chemical effect on iron of various cokes, etc., all of which are tabulated for easy comparison.

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Baldwin's Steam Heating Revised.

Reviewed by WM. KENT,* M. Am. Soc. M. E.

BALDWIN ON HEATING.—Or, Steam Heating for Buildings Revised. By William J. Baldwin, M. Am. Soc. C. E., M. Am. Soc. M. E. 16th Edition, revised and enlarged. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 4¾ x 7½ ins.; pp. 404; 16 plates and 124 text illustrations. $2.50; English price, 10c. 6d., net.

The first edition of Mr. Baldwin's well-known work appeared in 1879; the earlier editions were publisher's reprints without revision. The old book is now superseded by the present volume, which is in accord with modern practice. The author is a veteran in the steam-heating business, having made in 1869, with his own hands, the first cast-iron loop radiator. He has seen the warming of buildings grow from a "chaotic mass of pipes and principles" to its present position of a branch of engineering, based on scientific laws as well as practical experience. Those who are familiar with his old book will find the present one like it in method of treatment and in style of writing, and will appreciate the new matter, which brings it down to date and makes it a useful book for any one interested in the subject. It is an eminently practical book for the so-called "practical" man; that is, one whose work is with material things rather than with the laws of physics, and whose mathematical training has not included the use of algebraic formulas, for there is not a formula in the whole book. Rules for designing are given in words, involving often a great deal of repetition which might be avoided by a formula, and arithmetical calculations are often worked out in detail.

The book begins with a good illustrated description of the different systems of piping for steam heating; it then discusses forms and arrangements of radiators, both direct and indirect. Then follow chapters on boilers, boiler settings, grates and chimneys, safety valves, draft regulators, automatic water feeders and air-valves on radiators, all containing good practical information. There is a chapter on steam-pipe, area, expansion, etc., which might be improved. The author shows that the areas of "pipes are to each other as the squares of their diameters," and gives a full page table showing how many times the "area of one pipe will go into another," for example, that 16 1-in. pipes are equal to one 4-in., but he does not show that the carrying power of pipes, with the same length and the same difference of pressure, is at the 2.5 power instead of at the square of the diameter, so that one 4-in. pipe is equal to 32 instead of 16 1-in. pipes. Also, he gives the carrying capacity of a 1-in. pipe as equal to the steam required by 100 sq. ft. of radiating surface, and for larger amounts of surface figures the pipe on this basis, that the capacity is at the square of the diameter. This would make the capacity of a 4-in. pipe 1,600 sq. ft. and of a 10-in. pipe 10,000 sq. ft., while Wolff's table, which has been in use for over 10 years, gives 3,200 and 39,000 sq. ft., respectively, for these two sizes with steam of 5 lbs. pressure.

In Fig. 79, page 78, two methods of providing for expansion are shown, a V loop, and two right-angled bends, but a more approved method for long lines, two swinging joints, is omitted.

The remaining chapters of the book are full of practical information on such subjects as steam, air, exhaust-steam heating, separation of grease from exhaust steam, boiling and cooking by steam, drying by steam and by air, condensation in radiators, pipe-covering, etc. A chapter on "steam-heating data" gives brief approximate rules for rough preliminary calculations relating to steam heating and ventilation, including quantity of air, radiating surface, size of boiler, grate and chimney, quantity of steam to be furnished and of coal to be burned, etc. These are excellent as far as they go, but they might well be supplemented by the more scientific rules given by other authors, based on the heat unit.

The style of the author is not always clear, and there is sometimes difficulty in finding his meaning, as in the following sentence, p. 5:

System No. 2 is generally used in private houses, and in buildings where extremely low pressure is employed, and with any of the first three systems can be made perfectly noiseless when done with care, and there is rarely any difficulty in expelling the air when radiators are used.

Some good definitions of technical names are given in Chapter I., but that of a "relay," "the jumping up of a main steam-pipe, with a main relief at the lower corner," might be improved. The "dry-return pipe," p. 11, should be included in the definitions. A curious repetition of a preceding sentence appears at the bottom of page 15. On page 17 the word "friction" is used apparently to mean "loss of pressure due to friction."

On the whole, the book is a highly valuable one for the great amount of useful practical information it contains, and while it cannot take the place of more theoretical treatises, such as Carpenter's, it is one that should have a place in every heating engineer's library.

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MINES AND MINERALS OF THE BRITISH EMPIRE.—Being a Description of the Historical, Physical and Industrial Features of the Principal Centers of Mineral Production in the British Dominions beyond the Seas. By Ralph S. G. Stokes, Late Mining Editor, "Rand Daily Mail," Johannesburg, S. A. London, England: Edward Arnold. Cloth; 5½ x 8¾ ins.; pp. 403; 68 plates. $4.20, net.

Embodying the observations made during a two years' tour of the British Empire over sea, in the interest of certain mining papers, the author gives a review of the history and present situation of the mining industry in this wide territory. He presents the subject in a manner calculated to interest the non-technical seeker of general information, yet the data given have been selected with such discernment and are brought so closely to date that the book will commend itself to those connected with the professional as well as the commercial branches of the industry. Its literary style is attractive and illustrations in half-tone are copious, though a slight criticism may be offered of the absolute lack of illustrative sketches accompanying necessarily numerous geological descriptions. The exposition of industrial conditions in the various districts will prove of high value to readers who are or expect to become financially interested in them. The magnitude of the subject precludes great detail of delineation, yet a very nice sense of the proportionate values of different matter has enabled the author to give more information than is usually contained in works of similar scope. The facts recorded result for the major part from personal investigation necessitating the widest latitude of research and contact in situ with conditions of racial predilection, financial requirements and professional ambitions, an experience calculated to give a true perspective of the field's industrial activities which is successfully made apparent to the reader. A sense of humor spices such statements as are worthy of repetition, although not new; in example, we quote: "The fallacious precept of Barrier and Kalgoorlie unionism that skilled miners are born, not made, is discreetly ignored at Wallaroo, where the guidance of the inexperienced is not left to inspiration."

To give, within the limits of a review, even the merest résumé of the many subjects treated, from India to Tasmania and from Cape Colony to the Yukon, is not practicable. The minerals, with descriptions of their occurrence, exploitation, reduction and marketing, are regionally grouped. Questions of management, technical progress, labor and working costs and government influences are discussed. The book will doubtless attain popularity.

THE STANDARD HANDBOOK FOR ELECTRICAL ENGINEERS.—Written and Compiled by a Staff and Specialists. Second Edition, corrected. New York: McGraw Publishing Co. Flexible leather; 4 x 7 ins.; pp. 1285; numerous text illustrations and tables. $4, net.

The first edition of this handbook was dated December 12, 1907; the new edition bears the date, "May, 1908." An engineering book, especially a handbook, which has its first six thousand sold out in four months certainly would be classed as a "good-seller" and deserves attention. As there is little change from the first edition the same specific criticisms and commendations made in the review of the first edition (Engineering News, Feb. 20, 1908) apply equally to the second. The new volume is somewhat thinner than the old one, due to a lighter paper, and the binding is perhaps more flexible than before. The most noticeable addition is that of a thumb index to the group divisions. The division of the book into 20 sections, each with its own paragraph numbering, and the use of a general index referring to these paragraph numbers and not to pages made this thumb index to the 20 sections advisable. The only evident addition of material is on resuscitation from electric shock. There are a few typographical and minor changes and corrections throughout the book.

TESTS OF A LIQUID AIR PLANT.—By C. S. Hudson and C. M. Garland. Bulletin No. 21, University of Illinois Engineering Experiment Station. Urbana, Ill.: The University. Paper; 6 x 9 ins.; pp. 20; six illustrations in the text.

The plant on which these tests were made consists of a four-stage Norwalk air compressor and a Hampson liquefier of the laboratory type. The compressor was driven by a 15-HP. induction motor. The objects of the tests were to determine: (1) the power required to liquefy the air; (2) the cost; and (3) the most favorable conditions for operating. The effect of the temperature and pressure upon the efficiency of the liquefier was determined; and incidentally, some data were obtained upon the keeping properties of liquid air in Dewar bulbs of different sizes, and under different conditions.

An interesting paragraph relates to the efficiency of liquid air as a medium in the production of power. The ratio of the available energy of the liquid air to the work required to produce it was calculated under various conditions, and it was found that under the most favorable conditions, not more than 2½% of the work required to produce the liquid air can be recovered by using the air to drive a motor.

PASSAIC VALLEY SEWERAGE COMMISSIONERS.—Report to the Municipalities Lying in Whole or in Part within the Passaic Valley Sewerage District, 1908. Newark, N. J.: The Commissioners (Julius A. Lebkuecher, Chairman). Cloth; 13½ x 11 ins.; pp. 26 + vi.; folding tables and 73 plates.

This report presents a modified plan for the proposed Passaic Valley trunk sewer that has been under discussion for so many years. Besides the report of the Commissioners there is included a somewhat lengthy summary of a report by Messrs. Hering & Fuller, 170 Broadway, New York City. This report is accompanied by reproductions of numerous plans and profiles.

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Rack Railways and Rack-Rail Sections for Steep Grades on Ordinary Railways.

CHEMINS DE FER A CREMAILLERE.—By A. Lévy-Lambert, Principal Inspector of the Chemins de Fer du Nord. (Part of "Encyclopédie des Travaux Publics," begun by M. C. Lechalas.) Second Edition, revised and enlarged. Paris, France: Gauthier-Villars. Paper; 6½ x 10 ins.; pp. 479; 137 illustrations in the text and numerous tables. 15 francs; American price, $4.50.

The rack railway for steep grades is a special type of construction the literature of which is confined mainly to papers in the technical press and in the proceedings of engineering societies. This is shown by a bibliography appended to the book under review. The railways may be divided into two classes: (1) Lines operated entirely on the rack system; these are usually mountain lines for tourist purposes. (2) Lines having both rack and adhesion sections; these are usually for general traffic as well as for tourist traffic. Mr. Levy-Lambert states that in 1891, when the first edition of his book was written, there were 226.3 miles of rack railway in operation, and only one line (the Mount Saleve Ry.) had electric traction. In 1905, the aggregate length had increased to 803.5 miles and several lines were operated by electricity. The great majority are in Europe, but the United States, South America, Japan, India, Palestine, Sumatra, Africa and Australia are all represented in the list. The maximum grades range from 10 to 48%, this last being on the Mount Pilatus Ry.

The historical review begins with 1811, when Blenkinsop (in England) built a locomotive having cog wheels gearing with a rack laid alongside the track rails. This design was based on the erroneous idea that simple adhesion of iron wheels on iron rails would not be sufficient for traction purposes. This fallacy was soon exploded, and the rack system abandoned for ordinary service, but in 1836 a locomotive for steep grades was built in England (Wales) having a cog wheel which could be raised or lowered to engage with a rack between the rails. In 1847 (although the author says 1847 or 1852) a rack-rail was used in the United States on the incline of the Madison & Indianapolis Ry. [A full description of this line and its equipment was published in Engineering News of June 10, 1897.] In 1866 the Mount Washington Ry. was built by Mr. Marsh. A rack-rail system antedating that of Mr. Marsh was patented in France in 1863 by Mr. Riggenbach, but the author admits that it was not until his return from a visit to America in 1869 that Riggenbach commenced his project for the Rigi Ry., which was the first of the many rack railways in the Alpine mountain region.

A list is given of 50 rack railways built between 1871 and 1904; 35 of these are operated on the rack system exclusively. The others are rack-rail sections for heavy grades on ordinary railways. The author appears to have included most of the important lines, but gives no description of the Mount Washington Ry., the first rack-rail mountain railway. There is no mention of the Green Mountain Ry. (in Maine), but this is of little moment, as the line was abandoned some years ago on account of lack of patronage. It was copied after the Mount Washington Ry., and we believe the only detailed description published is that in Engineering News of Jan. 22, 1887. The book gives general descriptions of a number of lines (mainly European), with maps and profiles. Some notes are also given of the engineering works, including bridges and viaducts on heavy grades.

An interesting chapter is devoted to the rack and track construction, and the calculation of the forces to be resisted by the rack. The Marsh and the Riggenbach racks were of the ladder type, having cross bars carried between two longitudinal angles or channels. Mr. Abt (who had worked with Mr. Riggenbach) designed a rack composed of flat bars having teeth formed in the upper edge, and using one or more bars according to the grade. The special feature of this arrangement was that with two or more bars they were set with the teeth staggered. The engine cog wheels were built to correspond, and in this way several teeth would be in different stages of engagement simultaneously, distributing the pressure and making a more steady motion. This was first used on the Hartz Ry., in Germany, in 1885, and is the system used on the Pike's Peak Ry., in Colorado. The Strub rack, used on the Jungfrau Ry. in 1890, is a development of the Abt system; it resembles a tee rail with a very high head, the top of which is cut to form the rack. The Locher rack used on the Mount Pilatus Ry. is a flat bar like the Abt rack, but is laid flat and has both edges notched to engage with cog wheels in a horizontal plane. Other modifications are shown. The drawings illustrate various forms of joints and supports; also switches and turnouts, and the flexible section at the end of the rack to provide for the engine cog wheels entering smoothly into proper engagement with the race track.

The steam and electric locomotives used on railways of this class are discussed at considerable length, and the same chapter also deals with the rolling stock equipment. The larger locomotives operating over both rail and adhesion sections of railways for general traffic usually resemble ordinary tank engines, but with the addition of independent cylinders and mechanism for the cog wheels. The shafts of these wheels are usually driven by spur gearing. On many lines, however, the engines are of special design, some with vertical boilers and others with small locomotive tubular boilers set transversely to the track. Particulars of cost for fuel, oil, wages and maintenance are given.

Coming to electric traction, it is shown that independent locomotives (for both direct current and alternating current) are used by some lines, while others employ motor cars. The current is taken from overhead wires by trolley poles. While electric traction has many advantages, Mr. Levy-Lambert does not consider that it will replace steam traction on lines of considerable length, which have both rail and adhesion sections, and which operate a general passenger and freight traffic besides tourist traffic. The steam equipment is less costly and its operation is not dependent upon a single power plant; it can also be increased from time to time as required, while electric equipment must be designed with a view to future traffic and power capacity. The relative merits of direct and alternating current systems are not discussed. The weight of engines on different lines ranges from 213.4 lbs. to 343.2 lbs. per HP. for steam locomotives, and from 123 lbs. to 165 lbs. per HP. for electric locomotives, while the electric motor cars of the Mount Saleve Ry. weigh 220 lbs. per HP. Several styles of passenger and freight cars are shown; these have cog wheels whose axles are fitted with band brakes for the control of the train.

The cost of construction is given for a number of lines, and one chapter is devoted to the methods of operation. This includes the rules and regulations as to maintenance, inspection, train service, train loads, speed, etc., and particulars as to traffic conditions and financial results. The cost of operation of rack and adhesion sections is also compared. Appendices give in full the specifications and franchises, regulations, rates, financial statements, etc., of individual lines. The closing appendix describes tests made in regard to the "mountain sickness" experienced by many persons at high elevations. These indicate that the trouble is greatly accentuated by muscular exertion, and is therefore likely to be felt more severely by tourists and inexperienced persons who move about rapidly and exercise unnecessary activity.

The book is of general interest, but its practical value is of course limited. This is especially the case in this country, where only two or three short lines have been built for tourist traffic, and where no railway has yet introduced rack-rail operation for heavy grades or mountain sections. Little (if any) consideration appears to have been given to the latter system in this country, nor does it appear that conditions are such as to make it either necessary or desirable to adopt such a system. The book brings together in convenient form for reference much varied information which has not hitherto been easily available, and the information is of special value to the promoters and builders of railways of this class. In view of the special character of many lines (especially the shorter and steeper lines for passenger and tourist traffic), the value of the book would have been increased if the author had included in it some descriptions of and comparisons with cable, grip-rail and other systems as applied to incline railways for the same purpose.

Calculus.

FIRST COURSE IN CALCULUS.—By E. J. Townsend, Ph. D., Professor of Mathematics, University of Illinois, and G. A. Goodenough, M. E., Associate Professor of Mechanical Engineering, University of Illinois. New York: Henry Holt & Co. Cloth; 6 x 9¼ ins.; pp. 466; 150 figures in the text. $2.00.

The attempt to make Calculus more readily assimilable by the delicate mental digestive apparatus of the engineering student has been made repeatedly. Several text-books of greater or less currency embody such attempts. Professor Perry's "Calculus for Engineers" is undoubtedly the most noted of these, as it is also the most radical by long odds. The authors of the present text-book also worked in this direction, but they were not prepared to depart as far from the beaten path as Perry. Their text is correspondingly more orthodox in its method. A careless look into its pages might even convey the impression that it is exactly like other calculus texts used in colleges. But there are three features which individualize the treatment. The first is the sustained use of the method of limits for the entire basal demonstration; this is further carried out by deducing the differential notation as merely a modified way of writing expressions containing derived functions. The second feature is the early introduction of "anti-derivatives" or integrals, in the attempt to carry along the development of differential and integral analysis side by side. The third feature is the specially large use made of mechanical and physical laws and calculations, in the examples or problems which supplement the text. In this third feature, more than elsewhere, is it apparent that the book follows an intermediate path between the ordinary calculus text and Prof. Perry's work. There is good reason for following such a course, we believe, because, however refreshing and vital Perry's method may be, it beclouds the mathematics of the subject with the difficulties and complexities of the physical illustrations. However, the authors of the new book have in one important section of their work erred somewhat in the opposite direction, by making their initial teachings too abstractly mathematical. Simplicity and objective clearness have their maximum value right at this point, and if the concept of the derivative, or differential ratio, or rate of change, can be securely established by the aid of some simple physical and geometrical analogies, the engineering student may well be spared a lot of dreary mathematical argument.

CONTRIBUTIONS FROM THE SANITARY RESEARCH LABORATORY AND SEWAGE EXPERIMENT STATION.—Massachusetts Institute of Technology. Vol. IV. Boston, Mass.: The Institute. Paper; 6 x 8¾ ins.; text illustrations and one folding plate.

The papers here reprinted from various sources make up a valuable addition to the growing literature on the newer methods of sewage treatment. There is a brief introduction entitled "The Present Status of the Sewage-Disposal Problem," by Prof. William T. Sedgwick, Director of the Sanitary Research Laboratory. The papers are seven in number, by Messrs. C.-E. A. Winslow, Earle B. Phelps, C. F. Story, H. C. McRae, William T. Carpenter and Leyland Whipple. The general subject of Sewage Disposal, Effluents from Filters and the Prevention of Stream Pollution by Strawboard Waste are among the subjects discussed.

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A Student's Book on Refrigeration.

Reviewed by J. C. BERTSCH,* M. Am. Soc. M. E.

REFRIGERATION.—An Elementary Text-Book. By J. Wemyss Anderson, M. Inst. C. E., M. Inst. M. E. London and New York: Longmans, Green & Co. Cloth, 5½ × 8¾ ins.; pp. 242; 87 illustrations, mostly in the text. $2.25, net.

Written especially for the student, this book differs and compares favorably with all other books on that subject, inasmuch as examples are used for explaining the fundamental principles. The author makes good his claim that his work is an "elementary text-book to consider general principles only," and one following closely the plain and concise statements of facts with the examples given, and answering the questions asked after each of the introductory chapters, cannot fail to understand the matter fully. The author being an Englishman, the Metric and British standards are used. This might be considered a handicap for the practical engineer of this country, but for the student it is an advantage because he becomes familiar with foreign standards, and to substitute the U. S. Standard in the practical application of the rules will be no hardship. The book is divided into twelve chapters, of which the first six are devoted to the fundamental laws, two to the general principles and the last four to applied refrigeration. Many good illustrations and tables are used to make the subject perfectly clear.

In the introduction of his work the author explains what refrigeration means, and in stating the function of a refrigerating apparatus, which he terms a "Heat Pump," he gives a striking example by comparing the heat pump with an ordinary water pump, and with this example he furnishes the simplest proof for the Second Law of Thermodynamics. Chapter I. explains heat and its effects; the construction of thermometers and comparison of the different thermometer scales. A definition of the units of heat, specific and latent heat is given in Chapter II. Chapter III. treats the transfer of heat in the forms of radiation, conduction and convection, simple experiments being cited for demonstrating the theory of exchange in each form.

Chapters IV. and V. contain the properties of fluids and gases and the laws of Boyle, Charles and Joule. The isothermal and adiabatic compression and expansion are illustrated and made clear by numerical examples.

Chapter VI. is devoted to the Laws of Thermodynamics. Within the space of 14 pages, assisted by four illustrations, the second law as well as the Carnot and Rankine cycles are made perfectly clear, and this chapter alone is sufficient to recommend this book to all interested in the art of refrigeration, the teacher, student and practical man. Chapter VI. includes the theoretical, and with Chapter VII. begins the practical part of the book. In the general outline of the refrigerating machines the author points out why of the many known refrigerants ammonia and carbonic anhydride control the field. The cycle of refrigerant is fully illustrated. After describing the principles of the cold air machine, the ammonia and carbonic anhydride compressors are described, using as typical compressors the Linde and De La Vergne for the former, and the Hall and Liverpool machines for the latter. Then follows a description of the condensers. For explaining the Evaporators (Refrigerators) the "flooded" coils are shown as typical examples. For the sizes of compression machines tables from the American and English practice are given. The absorption system of refrigeration is clearly described and illustrated by a very good diagram. Chapter VIII. is devoted to Water, Hydrometers, Brine and Air. In connection with the latter hygrometery and liquid air are briefly explained. Chapter IX. deals with Ice Making.

The author's marked ability to make matters very plain and yet be very brief is fully demonstrated in this chapter. The formation of ice and the cause for opaque and clear ice are covered by a few pages. An excellent rule for calculating the time for freezing any thickness of can, coil or plate ice, as well as the best temperatures for ice making are given. The three principal systems of ice making are described, using reproductions of photographs from English practice as illustrations. The cell system, not practiced in this country, is of special interest. Then follows a description of the vacuum system, with short remarks on storing of ice and cost of ice making. Chapter X. gives much valuable information on the construction of storerooms, on insulation and methods of cooling. The remarks on the requirements of insulating material are of special interest, because they are based on practical tests, and the latest installations on shipboard are described.

Chapter XI. gives the various applications of refrigeration, including shaft sinking and air cooling for blast furnaces.

Chapter XII. is devoted to the actual arrangements of refrigerating plants. The brewery, ice factory and marine refrigeration are described in detail. A fully illustrated description of a double tube absorption plant is of much interest, and the concluding paragraph, "Care of Refrigerating Machinery," contains many practical hints.

The book as a whole is all that is claimed for it and can therefore be highly recommended. The publishers also deserve much credit for giving the book an outward appearance worthy its valuable contents.

*Refrigerating Engineer, 16 Nevarro Flats, Macon, Ga.

BEITRAG ZUR GESCHICHTE UND THEORIE DER SCHWEBEFAEHRBRUECKEN.—By Artur Speck. Leipzig, Germany: Wilhelm Engelmann. Paper; 7½ × 11 ins.; pp. 47; 36 illustrations in the text. 1.60 marks; American price, 64 cts.

As a monograph on a special type of structure this pamphlet on Ferry Bridges is peculiar because less than a dozen such structures have been built. The type is by no means very new. As the historical and descriptive summary in the first part of the book shows, a design for a cable suspension ferry bridge over the East River at New York was proposed in 1869 by J. W. Morse as a substitute for the fixed bridge later built, the Brooklyn Bridge. The author credits Morse with the invention of the ferry bridge; designs for cableway ferries, however, are several centuries older, and the ferry bridge is only a slight modification of the simple cableway.

The main part of Mr. Speck's monograph is given over to an exposition of the stress analysis of ferry bridges. This, of course, includes nothing new as concerns either the bridge (track) portion or the suspension and platform. In a discussion of the two types of suspension, i. e., flexible or rigid, the author supports the assertion that the former is preferable, because it is lighter, because it can never give rise to a tendency of the wheels to lift, and because it lacks the possibility of compressive stresses, as may occur in the rigid suspension, which are merely an added complication. As concerns stability he finds that the car with flexible suspension can be made as stable as desired, by proper inclination of the suspenders. The Duluth, Minn., ferry bridge, by the way, is the only one having rigid suspension. This structure, further, is repeatedly criticized as being ugly (unschön). However, an attempt of the author to produce a better design for a bridge of similar proportions (p. 44) impresses us as anything but an improvement.

Although a serious and capable attempt, the book hardly justifies its existence, since it contains nothing new and does not represent a condensation of widely-scattered data.

HYDRAULIC CALCULATOR FOR CIRCULAR PIPES.—Based on Kutter's Formula, with "n" the Coefficient for Skin Friction = 0.013. Designed by R. O. Wynne-Roberts, M. Inst. C. E., F. R. S. I. London, England: The St. Bride's Press, Ltd. Cloth; 4½ × 6¼ ins. 5s.; American price, $2.

By means of this calculator—a series of five superposed concentric circular pasteboard disks, two of which are movable about the center and the alternate ones stationary—it is possible rapidly to ascertain the proper sizes and grades of circular pipe for a given full flow of water, assuming a Kutter coefficient of 0.013. Thus knowing any two of the four factors, viz., gallons of flow per minute, diameter of pipe in inches, velocity of flow in feet per second, and grade of pipe, by simple manipulation of the circular slides, the two remaining factors may be arrived at.

CIRCULARS, FOREST SERVICE, U. S. DEPARTMENT OF AGRICULTURE.—Gifford Pinchot, Forester. (In Cooperation with the Department of the Interior, Geological Survey, George Otis Smith, Director.) Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.

No. 143: The Relation of the Southern Appalachian Mountains to Inland Water Navigation. By M. O. Leighton and A. H. Horton, U. S. Geological Survey. Pp. 38; 22 tables.

No. 144: The Relation of the Southern Appalachian Mountains to the Development of Water Power. By M. O. Leighton, M. R. Hall and R. H. Bolster, U. S. Geological Survey. Pp. 54; 50 tables.

In these circulars, facts and statistics are collated to show that the improvement of many rivers requires both the retention of the soil's forest covering and the use of storage reservoirs. Data accumulated from observations of the rivers whose head-waters originate in the Appalachian range are adduced in proof of the economic advantages, especially of water power and inland waterway traffic, to be gained by systematic protection of the forests.

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A Treatise on Power Stations.

STEAM-ELECTRIC POWER PLANTS.—A Practical Treatise on the Design of Central Light and Power Stations and Their Economical Construction and Operation. By Frank Koester, Assoc. M. Am. Inst. E. E., Consulting and Designing Engineer. New York: D. Van Nostrand Co. Cloth; 7¼ x 10¼ ins.; pp. 455; folding and other plates, and numerous text illustrations. $5, net.

The first two chapters consist of miscellaneous, heterogeneous, and to a considerable extent, unrelated remarks on plant efficiency, costs, factors affecting location and the general layout of a generating station. In these preliminary chapters serving as a sort of a broad introduction to the details of design, there are a great many statements where the probable meaning of the author as a reputable engineer is misstated, or misinterpreted. Thus where he writes:

> Since the efficiency of a steam-electric plant is so low, every increase in percentage of economy, be it ever so small a fraction, will materially improve the general results. . . .
>
> There are of course many other items to be taken into consideration to secure harmonious operation of the various machines, the ultimate object being to turn out a kilowatt for the least money. The economical operation of a plant is due to a great extent, first to the designer, who selects high efficiency machinery and combines the same properly, and secondly to the operator.

The context fails to qualify these statements and their repetition is surprising. The "general results" must be the cost of electric current supply, and that is influenced by more than the theoretical efficiency of the machinery. Often it has transpired that a less expensive and less efficient arrangement would have reduced the cost of a KW-hr. It should always be made prominent that that station which gets the greatest amount of electrical energy from the least amount of coal may not furnish it cheap to consumers. The weight of investment charges, depreciation and increased repairs on complicated machinery may be controlling factors of design at times. In another place we read:

> In the selection of auxiliary machinery, such as condensers and pumps, the type of prime movers should be considered. With the use of turbines, surface condensers are usually of greater efficiency; while with reciprocating engines, jet condensers may be successfully employed.

One might infer from this broadly and generally that the jet condenser was not to be used with the steam turbine. There are several notable installations in this country where jet condensing apparatus has been used with horizontal turbines, and in such installation the desired vacuum has been obtained and the plant efficiency has been kept comparatively very high.

In Chapter II the author has treated the location and general layout. He states the factors affecting location as: (1) distributing system; (2) coal and water supply and ash removal; (3) space for future growth and for coal storage; (4) cost and character of real estate. It seems like a marked omission here to make no mention whatever of the "center-of-gravity" methods of finding distributing or generating centers. While such centers are not necessarily controlling factors in determining the actual location they are probably made in the majority of preliminary studies for stations to supply electrical energy for general purposes.

In a section on "General Layout of Power Plants" the general and relative arrangement of boilers, coal handling plant, generating units, switchboards and auxiliary machinery is discussed, mainly by showing certain stations in America and Europe, such as those of the Interborough Rapid Transit Co. in New York City, the New York and Boston Edison companies, the Philadelphia Rapid Transit Co., the Commonwealth Electric Co., Chicago, the Manhattan Elevated R. R., the St. Denis Plant, Paris, the Chelsea Plant, London, the Rhenish-Westphalian, Essen, Germany; the Tramways Corporation, Glasgow, Scotland, and the Vienna Municipal Plants.

Chapter III, although entitled "Excavation and Foundation," is a discussion of subjects connected with the building as a whole. Such topics deal with the nature of the soil, pile and concrete foundations, building materials, walls, windows, doors, etc., the use of structural steel and architectural features. The advisability of good architectural treatment of the station buildings is discussed quite at length, and many illustrations are added showing elaborate foreign stations.

Chapter IV, while given the title "Boilers," nevertheless contains sections on mechanical stokers, coal combustion, draft, flues, chimneys, feed water and superheated steam. In writing of boilers themselves the author merely mentions the most general conditions under which fire-tube or water-tube types are advisable. The very important topic of grates is dismissed with the remark that

> grate surfaces should be proportioned to the kind of coal to be burned.

The subdivision labeled "grates" is diverted to take up ash and soot hoppers. The only boilers specifically described are the Babcock and Wilcox, the Stirling and the Wickes. Considering the number and merits of innumerable designs such an omission is remarkable. There is an equally surprising omission in the treatment of stokers. The Roney inclined and the chain grate stokers are the only ones adequately shown. There is a brief mention of the fact that underfed stokers exist. There is no discussion of the merits of standard grate bars and the fields for the use of prevalent designs. Nothing whatever is said of a very promising type of stoker—the strewing or mechanical shovel type which has appeared in Europe and gives promise of successful development in this country. Nothing whatever is added on the advisability of having combustion chambers or on the advisability of keeping gases, uncompletely burned, from being chilled by contact with water-cooled iron.

Considerable attention has been paid to superheaters, but American readers will look in vain for some things they most want. For instance, no mention is made of the influence of superheated steam is producing an apparently permanent extension in engine and piping parts. What is said about superheater design relates entirely to German practice—there is almost no word on English, French or American work. Indeed, some of the illustrations are reproduced with the original terms untranslated.

Chapter V on "Piping" seems to be a compilation from a wide variety of sources on high and low-pressure piping systems and fittings. Numerous tables and cuts are reproduced from catalogs of makers of fittings.

Chapter VI is entitled "Prime Movers" simply, but it includes remarks on engine auxiliaries—condensers, pumps and oiling systems. There is first a rather general comparison of reciprocating engine and turbine practice. There is a restatement of the familiar classification of engines—left and right hand, forward and backward running, simple, compound, etc. The turbines are divided into impulse, reaction, impulse-reaction, single impulse, "compound" impulse. Descriptions of well-known examples of the various types of prime movers are added.

Under the sub-division of "condensers" the author has included much about comparatively recent developments such as the Alberger barometric and the Koerting eductor condensers, cooling towers and ponds, roof-spraying systems, etc.

In the chapter on "Electrical Equipment," the matter is largely relative to switching systems and apparatus. There are a very few remarks on the general electrical machinery prefaced by an apologetic statement that the purely electric characteristics should be in the hands of the electrical engineer, who should work in conjunction with the mechanical. Following this chapter is one of some 25 pages on "The Design of Small Power Plants." Here is an epitome of the preceding chapters so far as they could be applied to a 1,500-KW. plant.

In the chapter on "Testing Power Plants" the space is filled by the statements of results of a few tests on certain boilers, turbines and generators. The many precautions which it has been necessary to throw around all such tests are hardly hinted at here.

The final 100 pages of the volume contain descriptions of the several plants mentioned before as having been used in the author's chapter on general layouts.

The book is, on the whole, disappointing. The author has treated nearly everythi[ng] in a most general way—general in the sense of [being] vague and indefinite and not in the sense of [being] broad and comprehensive. The author g[ives] the impression of being a spectator who [gets] results rather being a designer of worldwid[e] experience who is elucidating his own work. T[he] problems that the multitude of engineers on s[mall]er power work need light on are not reassuri[ngly] stated, for instance:

> The development of the electrical feat[ures] of power plants . . . has become so specialized i[n recent years] that . . . the power plant designer has [little] to do with this department. . . . As [to] service and economy of operation are both [of] portance it is necessary that the mechan[ical] trical engineers work in perfect harmony [with] and elec-

Such remarks may be perfectly tru[e for] large enough to have separate corps [of] mechanical and electrical engineers, but statio[n] designers under such conditions do not need m[uch] of what is offered between the covers of this b[ook].

BALKENBRUECKEN IN EISENBETON.—By Max Foerster, Professor of Structural Engineering at the Dresden Technical College. (Fortschritte der Ingenieurwissenschaften, Second Series, Part 15.) Leipzig, Germany: Wilhelm Engelmann. Paper; 7¼ x 11 ins.; pp. 204; 2 plates and 185 text illustrations. 7 marks; American price, $2.80.

A treatment of reinforced-concrete girder bridges at the present time is necessarily descriptive in the main. Accordingly we find that in Prof. Foerster's work—which includes not only full girder but also the small number of truss bridges hitherto constructed—description of finished work makes up more than half the contents. The remainder consists of specimen calculations for design or stress-analysis, which is not of very much value as an addition to the literature of concrete. The author brings ability and wide information to his task of compilation, and if not of high merit the book is at least sound. One regrets that the subject of forms and construction plant is practically unrepresented in the work. Surface finish also is accorded no special place. In fact, the author's attention appears to have centered on general disposition, dimensioning and reinforcement, disregarding the numerous auxiliary matters on which the reader also demands information and comment.

PHARES ET SIGNAUX MARITIMES.—By C. Ribière. Part of "Encyclopédie Scientifique." Published under the Direction of Dr. Toulouse. Paris, France: Octave Doin. Cloth; 4¾ x 7¼ ins.; pp. 405; 161 illustrations in the text. 5 francs; American price, $1.50.

The literature of lighthouses and maritime signals in the English language is probably amply sufficient for the limited uses to which it is put, but this small French work may prove of some value to lighthouse engineers, on account of its compact form. The following chapter headings will give some idea of the field treated: General Principles of the Lighting of Coasts; Theory of the Optical Apparatus of Lighthouses; Kinds of Light; Optical Lenses; Mechanical Apparatus in Lighthouses; Electrical Lighthouses; Auditory Signals; Floating Lights; and Construction of Lighthouses and Buoys.

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A Translation of a German Work on Metallography.

Reviewed by BRADLEY STOUGHTON.*

INTRODUCTION TO METALLOGRAPHY.—By Paul Goerens, Docent in Physical Metallurgy at the Royal Technical High School, Aachen. Translated by Fred. Ibbotson, A. R. C. Sc. I., Lecturer in Metallurgy, The University, Sheffield. London and New York: Longmans, Green & Co. Cloth; 5¾ x 9 ins.; pp. 214; 158 illustrations in the text. $2.50, net.

For many years there has been badly needed a text-book of metallography (i. e., the study of the structure of metals) for the use of colleges and scientific schools and for chemists and other scientists in metallurgical works who have desired more profound knowledge of the subject than they already possessed, for practical use. In some respects the literature of the subject was actually behind its practice and many useful studies were being carried on in steel works and elsewhere whose results were not recorded for the benefit of others. Furthermore, there was quite an appreciable gap between the researches in physical chemistry, a knowledge of which is indispensable for one who expects to successfully interpret the results of experiments in metallography, and those of metallurgists in metallography, which might almost be considered as within the realm of physical chemistry. This gap was painfully evident to those who do not read the French and German languages easily, and we warrant that many such will obtain their first introduction to the masterly interpretations of Grube, Mönkemeyer, Mathewson and others, in the translation of this book. The literary activity of Howe, Sauveur, Le Chatelier, Osmond, Heyn, Ledebur and others has done a great deal to bridge the gap, but much of the information was scattered among different tehchnical journals and was not readily available to a busy man. Goerens' book is the most complete exposition of the subject published and therefore well chosen for translation. We believe it will find important service as a text-book, and as side reading for practicing metallurgists. It is not as easy to understand as some of the translations of French works on physical chemistry, and this is the more unfortunate because the subject is very difficult of comprehension even with the ablest of presentations, but it has two advantages for metallographers over the physical chemistries: (1) it is written from the metallurgical, rather than the chemical, viewpoint, and (2) it contains data on pyrometry, microscopy, etc., which would not be found in the latter. The lack of lucidity is, we think, the fault rather of the form and substance of the original text than of the translator.

For American students the book is particularly adapted, because it contains only a very small share of the work of American investigators, and therefore presents a correspondingly larger amount of information less easily available to them. It is especially worthy of their attention.

The volume begins with a section called the physical properties of matter, including allotrophy, cooling curves and pyrometry. Although brief it is sufficiently complete and very serviceable. Instead of describing the graphical method of calibrating pyrometers, one involving mathematical calculations is given, but this omission is probably because Dr. Goerens believed (and justifiably) that all metallographers were familiar with the graphical method. The discussion of registering and differential pyrometers is very good.

The second section, on the physical mixture, is the largest, occupying 95 pages with the theories of solutions and freezing-point curves of aqueous solutions, fused salts and alloys. The phase law is briefly considered and then the process of producing freezing-point curves of different systems is described. A number of typical freezing-point curves are given under the following heads:

Binary Alloys:

A. No chemical compounds exist;

1. The two components form a continuous series of solid solutions: Antimony-bismuth; Gold-silver; Gold-platinum; Iron-manganese.
2. The two components form a mechanical mixture after solidification: Antimony-lead; Lead-tin; Cadmium-zinc; Lead-silver; Silver-tin; Bismuth-tin; Zinc-tin; Gold-thallium; Gold-copper; Silver-copper.
3. The two components are partly soluble in each other when solid: Aluminum-zinc; Gold-nickel.

B. One or more chemical compounds exist;

1. The compounds are completely insoluble, reciprocally as well as in the components: Lead-magnesium; Magnesium-tin; Nickel-tin; Antimony-zinc; Tellurium-bismuth; Sodium-tin; Lead-gold.
2. The compounds are wholly or partly soluble in the components or in one another: Aluminum - magnesium; Iron - silicon; Aluminum - copper; Magnesium - thallium; and fifteen others, including brass and bronze.

Ternary Alloys:

These are very briefly treated, even the bearing metals, and the amount of attention given to the basic principles and theories of this part of the subject is very small in relation to the rest of the book.

The third section, on practical microscopy of metals, covers the preparation of specimens, the development, the examination and the microphotographing of the structure. The principles underlying these processes are well explained; but the amount of space occupied (42 pages) does not give opportunity for much description of practice, or of types of practice. Several references are given, however, where different types of practice are described.

The last section deals with the metallography of iron and its alloys, and this has been rewritten and brought up to date by Dr. Goerens for the benefit of this translation. It is very elementary in character and somewhat incomplete, but is presented in an interesting manner and includes much valuable information.

*Adjunct Professor, Department of Metallurgy, Columbia University, New York City.

VERSUCHE MIT SAEULEN AUS EISENBETON UND MIT EINBETONIERTEN EISENSAEULEN IN STUTTGART UND IN WIEN.—By Fritz v. Emperger. (Part VIII., "Forscherarbeiten auf dem Gebiete des Eisenbetons.") Berlin, Germany: Wilhelm Ernst & Sohn. Paper; 7½ x 10½ ins.; pp. 57; 7 plates and 38 text illustrations. 5 marks; American price, $2.

This is a discussion of tests, with the full report of some new ones, on reinforced-concrete columns. They are ambitiously qualified as follows in the introduction:

> The executed test program embraces the entire domain of column strength, in that it discusses and takes account of all pertinent influences.

A later more moderate statement is less unacceptable:

> In this respect [full experimental investigation—Ed.] The present matter bears the character of preliminary tests, which serve not themselves to solve all problems but to present clearly the main questions.

The author extracts the following general conclusion from his test results:

> The tests furnish complete proof that the concrete-embedded steel column, as well as what we call steel-concrete [reinforced concrete], are statically to be regarded as steel columns . . . whose strength is increased by the strength of the concrete prisms between lattice points in proportion to the section of concrete surrounded by steel. . . .
> . . . Quite generally, even under the most unfavorable conditions, the buckling strength of the steel of the entire column and the simple crushing strength of the concrete between lattice [or tie] points are summed in the breaking strength of the column.

The increase of resistance in the concrete itself due to lateral confining action, he finds, is not obtained unless the spacing of the lateral ties is much smaller than is customary for columns other than pure hooped or banded columns.

MINISTER OF MINES (British Columbia).—Annual Report for the Year Ending 31st December, 1907. Being an Account of Mining Operations for Gold, Coal, etc., in the Province of British Columbia. (Richard McBride, Minister of Mines.) Victoria, B. C.: Pub. Doc. Paper; 7¼ x 10½ ins.; pp. 235; folding and other plates.

The mining operations for gold, copper, coal and other minerals, in the Province during 1907, have been carefully investigated by the Bureau, and the results are submitted in this report for the benefit of all interested in the region. Statistical tables give its total mineral output to date and show in considerable detail the actual mineral production of the past year, as based on smelter or mill returns.

SLOW BURNING OR MILL CONSTRUCTION.—Report No. 5, Insurance Engineering Experiment Station. Third Edition, revised and enlarged. Boston, Mass.: Insurance Engineering Experiment Station, 31 Milk St. Paper, 8½ x 11 ins.; 9 folding plates and numerous illustrations in the text.

The noted "mill construction" is still recommended in the strongest possible terms by the Associated Factory Mutual Fire Insurance Companies, in spite of the great development of construction in incombustible materials. Although this new edition of the association's pamphlet on slow-burning construction makes due acknowledgment of both the increased cost of timber and the lessened cost of erection of "the so-called fireproof" types, yet the early statement that

> timber posts offer more resistance to fire than either wrought-iron, steel, or cast-iron pillars, and in mill construction are preferable in many respects

together with some striking pictures showing how, in a fire, steel work failed earlier than heavy timber work, expresses the strong position accorded to wooden slow-burning or mill construction by the fire underwriters. The pamphlet is worth study and preservation.

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Scotch Marine Boilers and Allied Subjects.

Reviewed by D. W. TAYLOR.*

MARINE BOILER MANAGEMENT AND CONSTRUCTION.—Being a Treatise on Boiler Troubles and Repairs, Corrosion, Fuels and Heat, on the Properties of Iron and Steel, on Boiler Mechanics, Workshop Practices and Boiler Design. By C. E. Stromeyer, M. Inst. C. E., Chief Engineer of the Manchester Steam Users' Association. Third Edition. New York, London and Bombay: Longmans, Green & Co. Cloth; 6 × 9¼ ins.; pp. xx. + 404; 452 illustrations in the text and many tables. $4, net; United Kingdom, 12s. 2d., net.

This volume of over 400 pages is a third edition, the first having been published in 1893. The principal new matter incorporated in this edition is in connection with materials and the analysis of smoke-stack gases.

The scope of this work is fully indicated by its title. Only about a third of it is taken up by the portion dealing directly with the management and construction of boilers. The author also deals quite fully with questions of the properties of steam and water, boiler corrosion, combustion and heat transmission, materials, and applied mechanics as bearing upon boiler construction.

While Mr. Stromeyer's present position as chief engineer of the historic Manchester Steam Users' Association does not bring him in contact with the marine boiler, he was formerly an engineer-surveyor of Lloyd's Register, a position giving him access to extensive information upon the subject. His work is evidently a labor of love. The preliminary list of some 83 books and pamphlets and 90 periodicals and society transactions, as well as the very large number of other publications quoted from or referred to in the text, affords an idea of the author's research.

A very large number of subjects are considered in brief and condensed form, results obtained by numerous experimenters being quoted and copious references given to the original authorities.

While the portions dealing with the practical details of boiler construction and management are good, there are other works which well cover this field. But this work is unique in the amount of information it brings together upon subjects allied to the main theme; such diverse subjects, for instance, as the properties of steam, heat transmission, the manufacture and qualities of steel, the strength of flat plates and continuous beams and the qualities of fuel.

The last hundred pages of the book include a brief but excellent chapter on boiler design and boiler rules and tables, from the rules of Lloyd's Register and the British Board of Trade.

The author confines himself entirely to the cylindrical return-tube type of boiler, or the Scotch boiler, as it is commonly called in the United States. About the only reference to water-tube boilers is a list of books and publications on them. While water-tube boilers are largely used on vessels navigating the Great Lakes, they have been but little used to date on salt-water commercial vessels. But practically all naval vessels are now fitted with water-tube boilers. They have been fitted exclusively, for nearly fifteen years, on vessels of the British Navy, and it is to be hoped that Mr. Stromeyer, in future editions of this work, will at least touch upon this very large subject.

MORTALITY STATISTICS, 1906.—Seventh Annual Report. Bureau of the Census, S. N. D. North, Director. Washington, D. C.: Pub. Doc. Cloth; 9 × 11¾ ins.; pp. 480.

The benefits flowing from a permanent census bureau are shown with every report of this sort that is published. The volume before us is the second one dealing with the mortality statistics of a year in detail, supplemented by statistics for the preceding four years.

Owing to the failure of a large number of the States of the Union to provide any reliable system of registering vital statistics, only a small portion of the States is included in these mortality volumes. It is a pleasure to note, however, that in the present volume, 15 registration States are included, embracing 48.8% "of the total estimated population of Continental United States." The five States added are Pennsylvania, Maryland, South Dakota, Colorado and California. Those previously included were all the New England States, New York, New Jersey, Indiana and Michigan.

After the introductory text, the general death rate and the deaths from the principal causes, such as typhoid fever and other communicable diseases, are reviewed by means of text and brief tables; these reviews, however, relate to registration States and the larger registration cities, only. The bulk of the report is devoted to the detailed tables of deaths from various causes. They include the population of each registration area for each of the five years 1902 to 1906, inclusive. These populations are estimated by the arithmetic method adopted by the Bureau of the Census.

SAFE BUILDING CONSTRUCTION.—A Treatise Giving in Simplest Forms Possible Practical and Theoretical Rules and Formulae Used in Construction of Buildings and General Instruction. By Louis de Coppet Bergh, F. A. I. A., M. Am. Soc. C. E., Author of "Safe Building," etc. New Edition, thoroughly revised throughout. New York: The Macmillan Co. Cloth; 5 × 8 ins.; pp. 436; 289 illustrations, mostly in the text, and 50 tables. $5, net.

The "Applied Mechanics" of the simpler structural elements, together with rather fragmentary discussions of some special constructions, such as foundations, cellar walls, etc., form the contents of what the author entitles "Safe Building Construction." The selection and arrangement of the text-matter, as also the author's literary style, hardly conduce to maximum clearness. In fact, were it not for some scattered practical suggestions of more or less novelty, it would be necessary to say that the same field is covered in far better and more useful form elsewhere. It seems that the book is a re-edition of a work first printed over 20 years ago, and although according to the title-page statement it is "thoroughly revised throughout," there is such unmistakable flavor of its early origin as to arouse regret that the revision did not extend to scrapping the old text entire.

ELEMENTS OF WATER BACTERIOLOGY, WITH SPECIAL REFERENCE TO SANITARY WATER ANALYSIS.—By Samuel Cate Prescott, Assistant Professor of Industrial Biology, and Charles-Edward Amory Winslow, Assistant Professor of Sanitary Biology in the Massachusetts Institute of Technology. Second Edition, rewritten. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 4¾ × 7½ ins.; pp. 258. $1.25.

The first edition of this excellent little work for advanced students in bacteriology was noticed in our issue of July 14, 1904. In the present edition the authors state that they have endeavored to make necessary revisions to cover progress during the past four years. Particular mention is made of additions to the chapters on Self-purification, on the Isolation of the Typhoid Bacillus, on Colon Tests, and a new chapter has been provided on the Bacteriology of Sewage and Sewage Effluents. A quite extended bibliography is provided.

GRAPHISCHE HILFSTAFELN ZUR SCHNELLEN ERMITTELUNG DER TRAEGHEITSMOMENTE GENIETETER TRAEGER-JUERSCHNITTE.—Prepared by H. Nitzsche. Leipzig, Germany: Wilhelm Engelmann. Boards; 11 × 15¾ ins.; pp. 6; 10 plates and 5 text illustrations. 12 marks; American price, $4.80.

Ten full-page diagrams making up this book give values of moment of inertia for riveted girder sections, over a range of flange area from 0 to 150 square units, and distance between flange and neutral axis from 25 to 130 lineal units. The back of each plate, or rather the left-hand page opposite each diagram, gives tables of the following: moments of inertia of web-plates, and moments of inertia of two back-to-back angles around their own gravity axis, the latter for leg angles and for two shapes of unequal leg angles. These tables, metric, do not adapt themselves to use with our measures, but the diagrams can be used for inches just as well as centimeters, since the same unit is for flange area, for half-depth and for moment of inertia. The diagrams have variable abscissa spacing, so that the ordinates [$I = fc^2$] are straight lines. The awkward size of the book makes its use on the office desk inconvenient. In any case only a very large amount of work of the same kind would make it a time-saver. The occasions where slide-rule calculations would not be quicker and sufficiently accurate are few.

*Naval Constructor, U. S. N., U. S. Navy Yard, Washington, D. C.

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MASSENTRANSPORT.—A Text-Book on Transportation and Storage of Bulk Materials. By M. Buhle, Professor of Machine Design, Hoisting and Conveying Machinery, at the Royal Technical College, Dresden. Stuttgart and Leipzig, Germany: Deutsche Verlags-Anstalt. Paper; 7½ x 11 ins.; pp. 382; 856 illustrations in the text, and 80 tables. 20 marks; bound, 22 marks; American price, $8.

The present era is distinguished primarily by the employment of mechanical power—the steam engine—in the service of man. But as power itself is useless until it is put to efficient application, so the means by which and for which power is used are the real instruments of advance. Manufacturing machines are therefore the one great characteristic of the power era; devices for lifting, transporting, digging, etc., which lighten the load of laborious routine operations are another and perhaps equally important and characteristic. The railway car, the power crane, and the steam shovel are three implements of enormous influence on our daily life as individuals and as a race.

The railway is the only one of these implements that has a literature of adequate volume. The great field of other handling, lifting and transporting devices is almost totally without a permanent record. It is time this state of affairs were improved. The Germans have in recent years made a beginning, by publishing articles and books on one or another part of the subject, but the English literature in this field is still remarkably scanty. Two new German books, just published, represent commendable efforts at further supplying the missing record.

The first volume of "Die Förderung von Massengütern" deals with conveyors, that is continuous transporting and elevating machines. It is primarily descriptive, although there is interspersed some amount of theoretical analysis followed by formulas and constants for friction, power, etc. In view of the state of the art, the latter can probably claim no great definiteness or finality, however. The descriptive treatment is excellent. Beginning with the description of the varied forms of conveyor parts, such as links, buckets, driving devices, etc., the author takes up different types of conveyor under the following not entirely consistent classification: Scraper conveyors; Belt conveyors; Metallic-belt or link-belt conveyors, including also the Seeberger moving stairway; Bucket conveyors with fixed buckets; Bucket conveyors with tipping buckets; and lastly, Conveyors without belt, including live-roll beds, screw conveyors, shovel or reciprocating scraper conveyors, reciprocating trough conveyors or inertia conveyors, and pneumatic and hydraulic conveyors. In a closing section auxiliary devices are briefly considered, among them chutes, gates, loaders and automatic scales. Abundant illustration throughout forms one of the chief virtues of the work.

Buhle's "Massentransport" is a compilation of much more pretentious scope. Conveying and handling devices of all classes and kinds are included, beginning with railway cars, leading on through cableways and hoists to cranes and dredges, and thence to conveying machinery strictly so-called. This makes up about two-thirds of the book. The second part describes grain elevators and coal-storage plants. The third and last section describes very sketchily a number of types of plant which employ conveying and handling devices: gas works, boiler plants, ship and locomotive coaling plants, etc. It will be evident from the extensive ground covered that an immense amount of material must be contained in the book, and that at the same time the treatment cannot be exhaustive. This last is not subject to criticism, in view of the necessary limitations of space, but the order of arrangement of the matter is not quite as clear as might be desired, and seems likely to give rise to difficulty in referring to a specific detail of the general subject. Criticisms may also be made in the matter of balance. The relative amounts of space and detail study given to different sets of devices are not consistently in proportion to the needs of the subject, in the reviewer's opinion. Some simple or well-known devices are talked about at great length, while devices which are in much greater need of discussion are passed over more superficially. But opinion in this point is necessarily individual and variable.

The ground for these criticisms lies undoubtedly in the excessive extent of material included in the work. Three subjects so broad as railway cars, dredges and shovels, and conveyors, are here crowded together into less than 200 pages of text, although for even reasonably satisfactory treatment each by itself requires at least the whole of this space. Similarly Cranes, and Cableways, demand each a separate work. The attempt to crowd all these fields into one book makes it unavoidably superficial and fragmentary.

THE PRINCIPLES OF MECHANICS.—For Students of Physics and Engineering. By Henry Crew, Ph.D., Fayerweather Professor of Physics in Northwestern University. New York, London and Bombay: Longmans, Green & Co. Cloth; 5 x 8¼ ins.; pp. 295; 110 illustrations in the text. $1.50.

The author follows a method of instruction which we believe can hardly commend itself for general use in teaching Mechanics, at least not to engineering students. Beginning with a discussion of the elements of kinematics, all expressed in the rather indigestible terminology and symbols of vectors, the treatment continues in a style equally difficult for the learner. The method is no doubt logical, and in the sense that it seeks for precision and conciseness it is philosophical. But there is little to be said for a method which keeps the reader in ignorance of the term and concept "force" until the 84th page is reached, and even then gives him no better mental food than this: "The force acting upon any body is, therefore, defined as the rate at which the linear momentum of that body is changing." Moreover, forces are not even dignified by the author to the extent of giving a separate treatment of equilibrium of forces. The author states in his preface that one of his efforts in working out the text was "to reduce the inherent difficulties of the subject to a minimum." We believe the method employed is not sufficient for the purpose, in engineering schools at any rate.

LES NOUVEAUX LIVRES SCIENTIFIQUES ET INDUSTRIELS.—Vol. I. Bibliography of Works Published in France from July 1, 1902, to June 30, 1907. Paris, France: H. Dunod & E. Pinat. Cloth; 7 x 10½ ins.; pp. 416. 9 francs; American price, $2.70.

For the past five years the firm of Dunod and Pinat have issued every three month a bibliography, classified alphabetically by authors under subject headings, of the scientific and industrial books which had been published in France during the preceding quarter year. The present volume is a collection of all of these quarterly pamphlets, bound in one cover and preceded by a general subject and author index of the entire 20 subdivisions, from July 1, 1902, to June 30, 1907. Each of the 5,141 books published is noticed, in addition to the usual descriptive head, by a short résumé of the contained matter.

ANALYTISCHE ERMITTELUNG UND ANWENDUNG VON EINFLUSSLINIEN EINIGER IM EISENBETONBAU HAEUFIG VORKOMMENDER STATISCH UNBESTIMMTER TRAEGER.—By Arthur Lederer. Published by Rud. Wolle, Concrete Building Contractor, Leipzig. Berlin, Germany: Wilhelm Ernst & Sohn. Boards; 7¼ x 10¾ ins.; pp. 88; 13 plates and 113 text illustrations. 4.20 marks; American price, $1.68. Bound in cloth, 5 marks; American price, $2.

The title, "Analytic Determination and Application of Influence Lines," requires one or two explanatory notes. The following cases are discussed: the continuous beam of two spans, both equal and unequal; the continuous beam of three spans, both equal and unequal; the constrained (fixed-end) beam. The author apparently worked with special view to calculations of reinforced concrete, but he takes the product E I constant in each case. At the close of the text a series of diagrams is given, each being a scale drawing (with ordinates also given numerically) of the influence line for one position of load.

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An Introduction to Mechanical Engineering.

MECHANICAL ENGINEERING FOR BEGINNERS.—By R. S. M'Laren. London, England: Charles Griffin & Co., Ltd. Philadelphia, Pa.: J. B. Lippincott Co. Cloth; 5 × 8 ins.; pp. 282; 108 illustrations in the text and 24 tables. $1.75, net.

The author has aimed at giving a general introduction to the most important branches of mechanical engineering—strength of materials, steam-engine and boiler practice, gas and oil engines, hydraulic-power apparatus and hydraulic tools. The work is planned for engineering apprentices and young draftsmen, but recent technical graduates will find it profitable reading.

The properties, methods of production, testing and use of the more familiar materials from which machinery is built are first taken up.

In approaching steam engineering, the notable features of well-known types of boilers, such as the Lancashire, Cornish, locomotive, Scotch marine, Babcock and Stirling are first set forth. After these descriptions are elementary discussions of strength and design. Evaporation of water, combustion of coal and general boiler practice are explained as simply and briefly. Next the common steam power plant accessories are described, such as pumps, injectors, stokers, conveyors. Here no word is written on belt conveyors, which to an American engineer seems a peculiar omission. In "Steam Pipes and Valves" great emphasis is placed on the evils of water in pipes and valves and the more common layouts to prevent this are explained.

About a fifth of the book is on the steam engine, and this matter is in two parts. The first part does not go into descriptive detail, but rather shows principles as applied to common slide-valve, Corliss, Willans, high and low-speed engines. The second part gives the basic features of engine design: flywheel calculations, thickness of cylinder walls, proportions of crank shafts, journals, piston rods, etc. The steam engineering division is completed by descriptive chapters on condensers and steam turbines.

The sections on hydraulic machinery, gas and oil engines and on electrical matters are generally descriptive rather than taking up elementary principles of design. If the author had entirely left out his chapter on electrical things he would have an admirable book, but that one section is grossly misleading in important and elementary matters. What may be deduced here from some of Mr. McLaren's words may require to be later unlearned and such a process is always difficult. Some of the passages to which objection may be made are given below:

. . . . . in order to produce E. M. F. in a wire the latter must pass from a weak field, or no field, into a strong field or vice versa or, if moved continuously in a field of the same strength the speed must be varied, otherwise no E. M. F. will be obtained.

A 2,000 candle-power arc lamp of ordinary or open type absorbs about 500 watts so that in actual practice the engine driving the generator must indicate nearly 1 HP. for every 2,000 candle-power arc lamp.

If two conductors are placed side by side and an alternating current is sent through one of them, it will induce a current (having alternations in the opposite direction) in the other conductor, and the E. M. F. of the secondary or induced current can be made higher or lower than that of the primary current. Thus if a wire of large diameter, carrying a current of a good many amperes is placed alongside a smaller wire and having a greater resistance, the current induced in the latter will be of higher voltage, but of smaller amperage than in the primary wire.

A compound-wound dynamo is one in which a few turns of series winding are placed over the shunt winding and arranged to act in opposition to it. Thus if the speed of the generator should fall and the main current be reduced, the opposing power of the series winding will be reduced and the shunt winding, freed from this opposition will more strongly excite the magnets.

If one can pass by the electrical chapter the book is excellent for its intended purpose. It is brief by being concise and specific. One feature of the whole volume which should be of importance to young engineers is the arrangement of data. Thus the properties and costs of materials, usual dimension and constants of boilers, pumps, pipes, engines and various machinery are inserted where applicable. Such bits of information, while not absolutely accurate, give a good idea of the order of magnitude of the property in question. Thus the student learns that iron castings will cost in the order of $50 per ton; steel castings in the neighborhood of, say, $200 per ton. He will learn that a single-riveted lap joint in ½-in. plate has commonly, say, a ⅞-in. rivet with 2⅛-in. pitch and 2⅝-in. lap; that a double-riveted butt joint with double straps for ½-in. plate would have commonly 13/16 rivets pitched 3½ ins. He finds that the Parsons types of turbines have for, say 700 HP.., a speed of 1,500 to 3,000 r. p. m., while the speeds drop off with increased size until in a 7,000 HP. machine the speed is down to 700 or 1,000. However, throughout the book the student needs to bear in mind that British practice is dealt with and that American ideas depart from this widely at times.

HANDBOOK OF MATHEMATICS FOR ENGINEERS.—By L. A. Waterbury, Professor of Civil Engineering, University of Arizona. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Flexible leather; 2¾ × 5½ ins.; pp. 91; 61 figures in the text. $1, net.

A surprisingly large amount of mathematical notes and formulas crowded into vest-pocket compass, as here presented, should prove a very desirable addition to the engineer's equipment. The chief formulas of simple algebra, trigonmetry, analytic geometry and calculus are given in serviceable shape. Incidentally there is a short table of integrals nearly as useful as Peirce's "Short Table," and sufficient for practically all needs within the range of appeal of the book. This purely mathematical part is followed by two sections dealing with pure mechanics and mechanics of materials. The latter covers beams and columns, including continuous beams, beams loaded in a plane not passing through a principal axis of the section, eccentrically-loaded columns, and the consideration of normal column formulas as formulas for eccentric loading.

Good typography and substantial leather binding, and notched edges marking the several subdivisions, supplement the contents in making the little book a useful tool.

COAST EROSION AND FORESHORE PROTECTION.—By John S. Owens, M. D., Assoc. M. Inst. C. E., and Gerald O. Case. London, England: The St. Bride's Press, Ltd. Cloth; 5½ × 8¾ ins.; pp. 148; 34 illustrations in the text. 7s. 6d., net; American price, $3.

This summation of facts and theories of forces acting on coast and sea-bed, and of the best known means of protection against them, is a popular rather than scientific presentation of an as yet but slightly developed branch of engineering science; a branch, however, which is of great importance to some localities. The agencies producing movement of coast materials resulting in erosion or accumulation are carefully investigated, the first 70 pages, or half of the book, being devoted to an exposition of sub-aerial, wave, wind-current and tidal-current effects. In the latter chapters protection works, divided into "passive resisters," whose aim is to increase the strength and durability of natural sea barriers, and "active" means of defence, designed with the purpose of removing the causes of erosion, are described and fairly illustrated with half-tone and line engravings. Groynes, especially those of the "Case" type, are given prominence. The use of reinforced concrete is advocated for general subaqueous construction. The book promises to be valuable to all interested in its subject.

STATIONARY STEAM ENGINES.—Illustrated with Numerous Examples from Actual Practice. Edited by William H. Fowler, M. Inst. C. E., M. Inst. M. E., etc. Manchester, England: The Scientific Publishing Co. Cloth; 7¼ × 10 ins.; pp. 299; 326 illustrations in the text. 12s., 6d., net; American price, $5.

The material contained in this volume is stated to be in the main a collection of emended articles which have appeared at times in the (British) "Mechanical Engineer." The author has broadly classified all engines as stationary, locomotive and marine, and in this treatise on design has considered only the first class. The book should be acceptable to American engineers, designers and draftsmen, as it contains a large amount of data and description of machines from the leading European makers such as: Musgrave, Van den Kerchove, Robey, Borsig, Ferranti, Hicks-Hargreaves, Wallsend-Slipway, Galloways, J. and E. Wood, Escher Weiss, Gebruder Sulzer, Carels Freres, Bollincks, Williams and Robinson, Bellis and Morcom, W. H. Allen Sons Co., etc., etc. As might be expected in a British boo matter is made available on American than on European, although a few pro makes are described, such as the Westin Allis-Chalmers and McIntosh Seymour.

The author's method is to give method signing and proportioning engine parts, supplement these with discussions and tions of prominent types of machines. way the practical considerations of frames, valve gears, governors, fly-wheel cators, etc., are presented. The variou gears are treated quite fully. The des construction of fly-wheels forms one im chapter, in which the subject matter se be excellently presented, although there ar minor troubles with fly-wheels which a treated. The final chapter deals in a r way with the various arrangements of co ing apparatus, and while this section may brief or superficial to some readers it is pr satisfactory as an appendix to a work on design.

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Wireless Telephony.

WIRELESS TELEPHONY.—In Theory and Practice. By Ernst Ruhmer. Translated from the German by James Erskine-Murray, D. Sc., M. Inst. E. E. With an Appendix by the Translator. New York: D. Van Nostrand Co. London, England: Crosby Lockwood & Son. Cloth; 5½ × 8¾ ins.; pp. 224; 145 illustrations in the text. $3.50, net.

In 1907 Dr. Erskine-Murray issued a "Handbook of Wireless Telegraphy" to which this book is a companion volume. In size and binding the two are similar.

The solution of the problem of wireless transmission of speech over greater distances than the sound of the voice alone will carry has been effected in two general ways—by variations of light waves and by electrical waves. The first of these is as old as the telephone itself, and the second is perhaps the most recent step of notable scientific progress. These two divisions of work are treated in the two divisions of Dr. Erskine's translation of Ruhmer's German work.

The methods of the first part of the book depend on the alteration of the intensity of light radiations, sent out by some lamp acting as a transmitter, and on their conversion into sound waves at a receiver, usually through the action of light on the electrical conductivity of selenium. This section is historical, at least in the order of descriptions. Chapter III., on The Speaking Arc, is one of the very interesting portions of the book. Here the author describes the discovery and development of the direct-current arc as a reproducer of speech and music through auxiliary impulses of E. M. F. In another chapter he has given in detail his own interesting experiments with searchlight transmitters and selenium-cell receivers, by which he was able to get reliable communication up to some three miles.

The second part of the book is on wireless telephony by purely electrical phenomena. The author divides such communication into three classes: (1) by currents in the earth or water; (2) by electromagnetic or electrostatic induction; (3) by the propagation of electrical waves in the ether. The first two of these subdivisions are covered by relating the few somewhat successful attempts, through picking up currents caused to flow in the earth and through the mutual effects of long parallel circuits.

In taking up the third subdivision the author presents several early attempts (failures) to transmit speech by apparatus, more or less successful in wireless telegraphy, and with which damped trains of waves are produced by oscillatory spark discharges. A few methods are also described in which a very high-frequency machine was used to directly give rapidly alternating currents of appreciable magnitude from which were developed undamped trains of ether waves. Both the spark and high-frequency machine methods gave some promise of ultimate success, but were dropped when a solution of the problem was found in the "singing arc." The author, from this point, gives great attention to the methods proposed for developing undamped wave trains from the phenomena of an oscillating arc—one of a nature between a spark and an arc. In this field one encounters a mass of contradictory testimony which the author has attempted to properly correlate as explaining various actions between arc and spark phenomena. Yet in spite of such evident care, to a reader not well versed in the investigations of Duddel, Paulsen, Elihu Thomson, Simon, etc., etc., there will be a lack of that perspective in which the results of all such workers are properly to be viewed.

In an appendix the translator has added what he considers the real advances made from the date of the German edition of this book up to November, 1907. This part consists largely in a memorandum from Professor R. A. Fessenden on his work leading up to a test on a commercial system established between Brant Rock and Plymouth, Mass., a distance of eleven miles. It is surprising that in this appendix there is no adequate mention made of the De Forest system, which was adopted in 1907 for the United States Navy. Whatever may be said of the originality of employing certain phenomena in this system it still seems as though the very evident commercial success of the convenient apparatus developed would warrant giving here those details which were available before November, 1907.

In general, the author and translator have avoided extremely technical details that would be of interest only to those few persons whose major lines of work lies in these fields. The result has been that the greater part of the matter can be easily grasped at a single reading and the rest can be understood by a little study.

LEAD AND ZINC IN THE UNITED STATES.—Comprising an Economic History of the Mining and Smelting of the Metals and the Conditions Which Have Affected the Development of the Industries. By Walter Renton Ingalls, M. Am. Inst. M. E., Editor of the "Engineering and Mining Journal," etc. New York and London: Hill Publishing Co. Cloth; 6 × 9½ ins.; pp. 398; plates, text illustrations and tables. $4, net.

While intended as a part of the "Economic History of the United States," to be published by the Carnegie Institution, this interesting work is now offered as an independent publication by its well-known author. It attempts not so much to stimulate an antiquarian interest in the early discoveries and feeble attempts at exploitation of the lead and zinc deposits of this country, as to direct attention to the natural features, technical improvements and commercial issues which have contributed to the development of the industry. About two-thirds of the volume is devoted to lead as the more widely distributed and economically important of the two metals, although their close interrelation prevents complete separation of treatment. Both subjects are taken up in a similar natural arrangement of chapters. After an introductory statement of the principal mineralogical occurrences, the systems of mining employed in various districts are touched upon. This portion of the history arouses a feeling of regret that the author has neglected to elucidate the text with illustrations: such statements as "the vein resembles a wire bent sharply in two legs at an angle of 30°, one leg being short but of equal length to the other if its known extension underground be plotted" present difficulty even to a trained mind, while the layman who can form a clear mental picture of such concepts must be extraordinarily gifted.

The development of metallurgical processes from the primitive efforts which inaugurated the industry, to the comparatively high efficiency of modern methods, is presented quite fully; what, with less skillful literary treatment, might have become an unreadable mass of antiquated and useless data is here woven into a resumé of interesting facts chosen with a discrimination which yields a direct benefit to the reader in knowledge gained from the failures as well as from the successful experiences of our pioneers.

Completing the view of economic conditions under which lead and zinc have been and are produced in the United States, the commercial factors that have influenced the expansion of these resources are given. The business man's point of view is successfully taken in the explanation of costs, labor conditions, and trade agreements, from the Joplin prospector's and leaser's partnership to the ramified interests of the American Smelting & Refining Co. The book, while seemingly compiled with some haste, is for the major part clear, and contains so much pertinent cost data that it will prove valuable for reference as well as for study.

RAILROAD AND CANAL COMPANIES OF THE STATE OF NEW JERSEY.—Annual Statements, together with Report of the State Director of the United New Jersey Railroad and Canal Company for the Year 1907. (Joshua E. Borton, State Director.) Trenton, N. J.: Pub. Doc. Cloth; 5¾ × 9 ins.; pp. 387; one large folding table.

This volume, well bound in cloth, is an excellent example of how inefficient and routine work by an executive department can nullify the intent of legislation. So far as we can see, the volume is absolutely useless to any one. It is a direct reprint of the reports furnished by the various railroad companies and most of the space is taken up with the reports of accidents given seriatim. Thus, taken at random, on page 189 we read:

"November 3d—Minard, Clarence, Trainman, door shut on fingers, bruising same, Hoboken; November 5th—Trespasser, body found between tracks, Lyndhurst; November 7th—Passenger fell on crosswalk, bruising leg, Milburn."

This is a sample of the contents of the book for page after page. Why, oh, why, should good paper and ink be wasted in printing such useless matter? We cannot imagine, unless there is a percentage of profit in the printing and the state printer needed the money.

The State of New Jersey has made a belated beginning in attempting to supervise through state officials the operations of the railroad companies within its borders. Why should not these officials exert themselves enough to learn what other progressive states, like Massachusetts, Wisconsin and Texas, have been doing for many years? One is tempted to wish that there could be a law against the printing of useless official reports and a severe penalty for the official who perpetrated one. It is such documents as this which give excuse for the common remark that state regulation of corporations is a farce. It can be made a farce by the executive officials, or, in proportion as they are able and intelligent men, it can be made an instrument for real protection to the public.

Publicity is referred to again and again as a panacea for the evils of corporation mismanagement, but there is publicity that is effective and valuable, and there is a so-called publicity that complies with the law but buries facts deep in bulky reports where they are of no use to any one.

POOR'S MANUAL OF THE RAILROADS OF THE UNITED STATES.—Street Railway and Traction Companies, Industrial and Other Corporations. Forty-first Annual Number, 1908. New York: Poor's Railroad Manual Co. London, England: Effingham Wilson. Cloth; 5¾ × 9 ins.; pp. clxxviii. + 2089; folding and other plates, and text illustrations. $10.

The 41st annual issue of Poor's "Manual" is notable for its departure from past precedent in including industrial corporations. The "Manual" has long been the standard work of reference in all financial offices, and the growing amount of investments in industrial corporations has been recognized in previous years by including a certain number of the most important and well-known industrial companies. In the present volume, however, the space is largely increased, and practically all the industrial companies whose securities are dealt in on the exchanges are included, as well as a very considerable number of concerns the stock of which is seldom quoted. A table of the dividends paid by industrial corporations and of their annual meetings and transfer agents is also convenient, and there is a directory of the purchasing

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Publications Received.

ADDRESSES DELIVERED AT THE INSTALLATION OF WILLIAM FREEMAN MYRICK GOSS, D. ENG., AS DEAN OF THE COLLEGE OF ENGINERING, UNIVERSITY OF ILLINOIS.—Feb. 5, 1908. No. 1, College of Engineering Series, University of Illinois Bulletin. (Urbana, Ill.: The University.) Paper; 6 × 9 ins.; pp. 59; illustrated.

DIE ASANIERUNG VON DUESSELDORF.—(The Sanitation of Düsseldorf.) Prepared by Messrs. Brix, Freihr, Engelhardt, Geusen, Mangold, Schenk, Schrakamp and Tremus, under the supervision of Dr. Th. Weil. Part 17, Group II., Fortschritte der Ingenieurwissenschaften. Leipzig, Germany: Wilhelm Engelmann. Paper; 7¼ × 11 ins.; pp. 178; 8 plates and 96 text illustrations. 14 marks; American price, $5.60.

BOARD OF RAILROAD COMMISSIONERS.—(Massachusetts.) 39th Annual Report, January, 1908. (Walter Perley Hall, Chairman, 20 Beacon St., Boston, Mass.) Boston, Mass.: Pub. Doc. Cloth; 5½ × 9 ins.; pp. xiii. + 387 + 656; two large folding maps.

BULLETINS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.

No. 328: The Gold Placers of Parts of Seward Peninsula, Alaska. Including the Nome, Council, Kougarok, Port Clarence, and Goodhope Precincts. By Arthur J. Collier, Frank L. Hess, Philip S. Smith, and Alfred H. Brooks. Pp. 343; 11 plates (4 in pocket) and 19 text figures.

COMMISSIONER OF DAMS AND RESERVOIRS.—State of Rhode Island and Providence Plantations. Annual Report made to His Excellency, James H. Higgins, Governor, January, 1908. (Walter C. Simmons, Commissioner.) Providence, R. I.: Pub. Doc. Paper; 6 × 9 ins.; pp. 34; folding plates and text illustrations.

EXPERIMENTS WITH RAILWAY CROSS-TIES.—By H. B. Eastman, Forest Assistant. Circular 146, Forest Service, U. S. Department of Agriculture, Gifford Pinchot, Forester. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 22; two folding plates, one text figure and nine tables. 5 cts.

THE FINAL DISPOSITION OF CITY REFUSE BY MIXED REFUSE DESTRUCTION, AND THE FINAL DISPOSITION OF REFUSE IN GREAT BRITAIN.—By J. T. Fetherston, Assoc. M. Am. Soc. C. E. (Reprinted from the Journal of the Society of Chemical Industry, April 30, 1908.) (H. Schweitzer, Secretary New York Section, 66 Lafayette St., New York.) Paper; 4¾ × 7 ins.; pp. 11; four illustrations in the text.

HOW TO BECOME A COMPETENT MOTORMAN.—A Practical Book on the Proper Method of Operating a Street Railway Motor-car; with Instructions How to Overcome Troubles on the Road. By Virgil B. Livermore, Inspector, N. Y. C. & H. R. R. R., and James R. Williams, Mechanical Expert Department, Galena-Signal Oil Co. Second Edition, Revised. New York: D. Van Nostrand Co. Cloth; 4½ × 6½ ins.; pp. 247; 60 illustrations, mostly in the text. $1, net.

HYDRAULICS OF RIVERS, WEIRS AND SLUICES.—The Derivation of New and More Accurate Formulae, for Discharge through Rivers and Canals Obstructed by Weirs, Sluices, Etc., According to the Principles of Gustav Ritter von Wex. By David A. Molitor, M. Am. Soc. C. E., Designing Engineer, Isthmian Canal Commission. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 135; text illustrations and tables. $2, net; English price, 8s. 6d., net.

INTER-COLONIAL IRRIGATION COMMISSION.—Final Report, Presented to Both Houses of Parliament by Command of His Excellency the Governor. (C. D. H. Braine, Assoc. M. Inst. C. E., Secretary of Commission.) Pretoria, Transvaal: Pub. Doc. Paper; 8¼ x 13 ins.; pp. 148; one plate and two folding maps.

AN INVESTIGATION OF THE HYDRAULIC RAM.—By Leroy Francis Harza. Researches in Hydraulics, Daniel W. Mead, Professor of Hydraulic and Sanitary Engineering. Bulletin of the University of Wisconsin, No. 205. Madison, Wis.: The University. Paper; 6 × 9¼ ins.; pp. 111; one folding plate and numerous text illustrations. 25 cts.

LABOR CONDITIONS IN THE PHILIPPINE ISLANDS.—By J. W. Beardsley, Director of Public Works. (Reprinted from Engineering News of Nov. 23, 1905.) Manila, P. I.: Pub. Doc. Paper; 6 × 9¼ ins.; pp. 29; four illustrations in the text.

LIST OF WORKS RELATING TO DEEP WATERWAYS FROM THE GREAT LAKES TO THE ATLANTIC OCEAN.—With Some Other Related Works. Books, Articles in Periodicals, United States Documents. Compiled under the Direction of Appleton Prentiss Clark Griffin, Chief Bibliographer, Library of Congress. Washington, D. C.: Pub. Doc. Paper; 7 × 10 ins.; pp. 59. 10 cts.

NORTHWESTERN CEMENT PRODUCTS ASSOCIATION.—Proceedings of the 4th Annual Convention, Chicago, Dec. 18-19, 1907. Edited by the President, Martin T. Roche (410 Pioneer Press Building, St. Paul, Minn.). Paper; 5¾ × 8¾ ins.; pp. 164; illustrated.

PRACTICAL IRRIGATION.—Its Value and Cost. With Tables of Comparative Cost, Relative Soil Production, Reservoir Dimensions and Capacities, and other Data of Value to the Practical Farmer. By Aug. J. Bowie, Jr. New York: McGraw Publishing Co. Cloth; 6 × 9½ ins.; pp. 232; 53 illustrations in the text and 74 tables. $3, net.

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RAILWAYS.

ALASKA CENTRAL.—This company, which was recently placed in the hands of a receiver, will be reorganized. Company was incorporated to build a railway from Seward on south coast of Alaska north to near Fairbanks, on Tanana River, 450 miles. Of this, 52 miles from Seward north were in operation Sept. 1, 1907, and 60 miles additional under construction, contract having been let for first 185 miles. Branch is proposed from Knik, about 150 miles from Seward east to the Manatuska coal fields, 58 miles. Pres., A. C. Frost, Chicago; Vice-Pres., H. C. Osborne, Toronto; Secy., James A. Haight, Seattle; Asst. Secy., Pierre G. Beach, Chicago; Treas., G. L. Francis, Toronto, Trustees: Albert C. Frost, Chicago; Henry C. Osborne and Gwyn L. Francis, Toronto, Ont.; George A. Ball, Muncie, Ind.; George Turner, Spokane, Wash.; F. Augustus Heinze, Butte, Mont.; James A. Moore and James A. Haight, Seattle. Executive offices, 108 LaSalle St., Chicago. The company was incorporated under the laws of the State of Washington on March 1, 1902. Its main offices were in the Denny Bldg., Seattle. Noted on June 4.

ARKANSAS.—John H. Camp, Morrellton, Mo., advises us that he is interested in the promotion of a railroad from Hot Springs, Ark., to Paris, Tex., a distance of 250 miles. He desires to communicate with engineering companies and also wishes estimates on construction work, equipment, etc. Motive power at first will be steam, but it is planned to eventually use electricity.

BINGHAM & GARFIELD.—Incorporated in Utah with $1,000,000 capital stock. It is stated that the line will be built principally in the interest of the Utah Copper Co., connecting its mine with the concentrating plant. The road will be 35 miles long and will serve other mining companies, Boston Consolidated's mill and a sand smelter at Garfield, the terminus. W. S. McCormick is Pres.; D. C. Jackling, Vice-Pres., and John M. Hayes, Secy. and Treas., Salt Lake City.

CANADIAN PACIFIC.—Bids will be received by C. E. Cartwright, Ch. Engr., Vancouver, B. C., until noon, July 31, for grading and bridging on eleven miles of the Esquimalt & Nananimo extension to French Creek. Noted on July 2.

CAZENOVIA & SAUK CITY.—Incorporated in Wisconsin to build from La Belle, Wis., to Sauk City, 40 miles, connecting with the Chicago, Milwaukee & St. Paul Ry. at Sauk City. Capital, $30,000. The incorporators include Joseph Duren, Joseph Lamkuehler and John Hanzlik, all of Cazenovia, Wis.

CENTRAL OREGON.—Alfred F. Biles, F. S. Stanley, Jesse Sterns and Roscoe Howard of Shaniko and Prineville, have incorporated this company to build a railroad from Shaniko to Prineville and Bend, Ore. Capital, $50,000.

CHICAGO, JOLIET & KANSAS CITY.—At a special meeting of the shareholders of the Chicago, Joliet & Kansas City R. R. Co. in Chicago, on July 6, it was voted to increase its capital stock from $1,500,000, issued two years ago, to $15,000,000. Company proposes to build from Chicago, via Joliet, Ill., to Kansas City, Mo., 350 miles, with branch to Keithsburg, Mo. W. Garnett is Secy. Company's headquarters are the Rookery Bldg., Chicago.

ESQUIMALT & NANANIMO.—See Canadian Pacific.

GEORGIA SOUTHWESTERN & GULF.—Official announcement is made that this company will build a line 160 miles long from Albany, Ga., southwest to St. Andrews Bay, Fla., on the Gulf of Mexico, via Colquit and Donaldsonville, Ga., and Marianna, Fla., with another road from Dawson, Ga., to connect with the main line about 30 miles west of Albany. Date is not yet fixed for receiving bids. W. M. Legg is Pres., 534 Washington Ave., Macon, Ga.; J. R. Mercer, Vice-Pres., Dawson, Ga.; H. J. Bruton, Secy. and Treas., and Russell & Hawes, General Counsel, at Bainbridge, Ga. T. H. Hazelbrigg is Consult. Engr., 126 East Market St., Indianapolis, Ind. Noted on June 25.

IDAHO.—Z. A. Johnson, of Nezperce, is promoting a railway from Nezperce to connect with the Northern Pacific Ry.'s Culdesac-Grangeville line in the vicinity of Vollmer. A proposition has been accepted by Nezperce which provides for a bonus of $50,000 to be paid when the road is completed. The estimated cost of the road is $150,000.

LAKE ERIE & PITTSBURG.—The New York "Tribune" states that it is reported in Pittsburg that "the Vanderbilt system and the Pennsylvania R. R. Co. have closed a deal whereby the Erie R. R. is to be cut out of any traffic from the Pittsburg district. The combined railroads have purchased the Lake Erie & Pittsburg R. R. Co. for $5,000,000, of which the Vanderbilts will pay $2,500,000 to Wm. Keneffic and John B. Carter, of Kansas City, Mo., who owned the proposed route from Pittsburg to Lorain, Ohio. The Pennsylvania Company put into the deal its short line from Kent to Lorain for $2,500,000." It is announced that construction work on the Lake Erie & Pittsburg line will be commenced at once.

LAS VEGAS & TONOPAH.—Arthur Maguire, Las Vegas, Nev., Ch. Engr., is running survey for the proposed line between Flagstaff and Jerome, Ariz.

MARION & RYE VALLEY.—Survey is being made for an extension. Company now operates 18 miles of railway, connecting Marion, Va., with Sugar Grove. J. C. Campbell is Pres. and Gen. Mgr., Marion.

MISSOURI & NORTH ARKANSAS.—The construction of a branch line to Little Rock, Ark., has not been definitely decided beyond authorizing a preliminary survey and investigation as to construction expense and probable operating results. Company now operates 171 miles of railroad, from Neosho, Mo., to Leslie, Ark. W. S. Dawley is Ch. Engr., 820 Security Bldg., St. Louis, Mo.

PORT ARTHUR & HOUSTON SHORT LINE.—C. S. Cleaver, Vice-Pres. and Gen. Mgr., at Houston, Tex., announces that contract for the entire construction of this railway has been let to D. H. DONOVAN, of the Pennsylvania Construction Co., St. Louis, Mo., who has sublet the grading contract to C. L. DWYER, of Houston, Tex. Line will be 80 miles long, extending from Port Arthur to Houston, Tex., via Hampshire, Wallisville, Cedar Bayou and La Porte, Tex. A. O. Blackwell is Secy. and A. N. McKay, Treas., at La Porte, Tex. The board of directors include the officers and H. F. Best, John R. Adams, Hans Falkenburg and Jan Van Tyne, all of Port Arthur, Tex. The office of president is vacant. Hans Falkenburg is Ch. Engr. Previously noted.

PRINCE EDWARD ISLAND RY.—A branch line will be built from Harmony to Elmira. D. Pottinger is Gen. Mgr., Moncton, N. B.

RAHWAY VALLEY R. R.—This railroad is a 12-mile line constructed from Summit to Elizabeth, N. J., for the purpose of connecting the Delaware, Lackawanna & Western Railroad, the Jersey Central Railroad, the Lehigh Valley Railroad, and the Pennsylvania Railroad with one another, and supplying the intervening country with freight and passenger advantages on these various roads. It has been handicapped for the last two years by the Lackawanna's unwillingness to grant a connection at Summit. This case was argued before the full Interstate Commerce Commission at Washington a month ago and created a good deal of interest, owing to the fact that it was the first case of its nature brought up under the interstate commerce law, according to the New York "Times." The decision of the Interstate Commerce Commission, filed on July 9, says: "It is ordered that the defendant, the Delaware, Lackawanna & Western Railroad Co., be and is hereby notified and required to construct on or before Dec. 1, 1908, and maintain and operate during a period of not less than two years a connection with the transfer of freight from the existing siding leading to the ice-house and the coal dock thereon of said Delaware, Lackawanna & Western R. R. Co. to the line of the complainant, the Rahway Valley R. R. Co., in the town of Summit, N. J., and in the opposite direction, but the expenses of such connection shall be borne by said complainant." The order is subject to modification at any time when the defendant so changes its track at Summit as to make such a connection impracticable or unsafe. H. F. Dankel is Gen. Mgr. of the Rahway Valley Co., Kenilworth, N. J.

SANOODY VALLEY.—This company will build a railroad twelve miles long from DeKalb, Miss., to Sucarnochee, on the Mobile & Ohio R. R. It will cost $100,000, of which $40,000 is subscribed, and it is expected to float $60,000 of bonds. Samuel O. Bell, of DeKalb, A. A. Overstreet, T. D. Stennis, T. A. Hopper and others are the incorporators.

VIRGINIA.—C. P. E. Burgwyn, Engr., 2 North Tenth St., Richmond, will survey a line for the Emporia Lumber Co. to locate a railroad from its large timber lands in Lunenburg County to the Southern Railway at either South Hill or LaCrosse.

WATERLOO, PELLA & SOUTHWESTERN.—We are officially informed that this company has made a deed to the Knickerbocker Trust Co. for $3,500,000. Bonds for $1,200,000 have been issued for building the division from a point on the Wabash Ry. south of Pella to Grinnell, Iowa, 42 miles. Surveys, plans and estimates are made. The main line will be 120 miles long, with 20 miles of sidings. It will connect Waterloo, Traer, Toledo, Tama, Sheridan, Grinnell, Sully, Pella, Harvey, Howell, Attica, Olnitz and Chariton, Iowa. B. F. Keables is Pres.; E. A. Harris is First Vice-Pres. and Gen. Mgr., and T. L. Blank is Ch. Engr., Pella, Iowa. Noted fully on Jan. 9.

WINNIPEG, YANKTON & GULF.—This company plans to build a railroad from Winnipeg, Man., (Canada) to the Gulf of Mexico at either Matagorda Bay or Port Arthur, Tex. Company is financially ready to build 800 miles of line and equip it. Route is from Superior, Neb., via Mankato, Beloit, Lincoln, Wilson, Great Bend, St. John, Greensburg and Coldwater, Kan.; Buffalo, Woodward, Mutual, Seiling, Taloga, Canton and Watonga, Okla., to Oklahoma City, about 500 miles; also from Buffalo, Okla., west via Beaver, Guymon and Kenton, Okla., to Des Moines, N. Mex., about 300 miles. Permanent headquarters at Great Bend, Kan. $21,000,000 of first mortgage 5% bonds have been sold to a syndicate in London, England. H. L. Miller, Pres., Russell, Kan., will let contracts. Other officers are W. L. Smith, First Vice-Pres.; Charles Lundblade, Second Vice-Pres.; O. W. Dawson, Secy.; J. George Brinkman, Treas.; G. W. Moses, Gen. Mgr., all of Russell. Notice of charter being granted in issue of June 18.

ELECTRIC RAILWAYS.

PITTSFIELD, MASS.—Approval for a street railway location in Massachusetts that is expected to form a part of the through line projected between Buffalo and Boston has been asked of the Massachusetts Railroad Commissioners by a petition from the Pittsfield Electric St. Ry. Co. The proposed location would extend the lines of this company from Pittsfield to the New York-Massachusetts boundary, where a New York line is projected from Albany to meet it. The Pittsfield location begins at the boundary line between the city and Hancock, near the office of the West Pittsfield Shakers, and runs westerly on the State highway through the town of Hancock to the edge of the town of Lebanon, stopping at the State boundary. The Pittsfield directors signing the petition are Alex Kennedy, J. L. Bacon, J. M. Stevenson, Charles E. Merrill and P. C. Dolan. As noted July 2, "the Pittsfield Electric St. Ry. Co. has been granted a franchise to operate an electric railway in Hancock. About five miles of line will be built. P. C. Dolan, Pittsfield, is Pres. and Mgr."

HARTFORD, CONN.—Proposals for the construction of the trolley line between Middletown and Hartford, through Cromwell and Rocky Hill, will be received at the office of The Connecticut Co., New Haven Conn., until July 16. The line will be about 16 miles long. J. K. Punderford is Gen. Mgr.

HOPKINTON, R. I.—We are officially advised that the Ashaway & Westerly R. R. Co. has awarded contract for building its line to ALLEN & PHELPS, of Stanhope, N. J., and Binghamton, N. Y., not Norwich, Conn., as noted last week. It will be about five miles long. Noted fully on June 11. Frank Kramer is Ch. Engr., Westerly.

WATERBURY, CONN.—The Connecticut Company, we are officially advised, expects to have its line completed connecting Waterbury and Woodbury early in August.

ROCHESTER, N. Y.—On July 7 the Rochester, Corning & Elmira Traction Co. applied to the Public Service Commission at Albany, to modify its order that the entire capital stock must be taken at par before any bonds were issued. The company stated that it has made diligent efforts to comply but found that by reason of the fact that no part of its road is yet complete or in operation, it is impossible to obtain subscriptions to its entire capital stock at par. The company asks leave to build and put in operation a portion of its line from Rochester and Lakeville to Conesus Lake, N. Y., 25 miles, the cost of which will be $1,277,000, and later to build from Lakeville to Dansville, an additional 25 miles, at a cost of $1,705,610. The company asserts that it will be able to construct and put in operation its road from Rochester and Lakeville to Conesus Lake from the proceeds of $1,000,000 and $500,000 stock, and requests authorization for such an issue. The request is made to build a road from Lakeville to Dansville for an issue of $1,250,000 bonds and $750,000 stock at par. It is the intention of the company to operate the first section by purchased power and for the second section it will build a powerhouse to operate the entire 50 miles proposed. The commission will decide the matter at an early date. The ROCHESTER & SOUTHERN CONSTRUCTION CO., 624 Exchange, St., Rochester, has construction contract. Noted on April 16.

JOHNSTOWN, PA.—The Southern Cambria Ry. Co. has begun construction work on its proposed line which is to connect Johnstown, Conemaugh, Mineral Point, South Fork, Ehrenfeld, Summerhill and Ebensburg, comprising about 24 miles of track. The power station and repair shops will be located at Mineral Point. The overhead trolleys will be used. The officers are: George M. Wertz, Johnstown, Pres.; P. J. Little, Ebensburg, Secy.; G. Walters, Johnstown, Treas.; James Bryan, Pittsburg, Electrical Engr., and William Butler, Johnstown, is Ch. Engr.

BALTIMORE, MD.—The Baltimore, Halethorpe & Elkridge Ry. Co. has surveyed its line and is about ready to begin construction. Carville D. Benson, 609 Law Bldg., Baltimore, is named as the promoter of this project. Noted on Nov. 21, 1907.

ASHEVILLE, N. C.—The Weaverville Electric Co. will receive bids for building four miles of railway. John H. Carter is Pres.; G. W. Epps, Secy.; R. S. Howland, Treas.; B. M. Lee, Ch. Engr., all at Asheville.

SANDERSVILLE, GA.—J. E. Johnson, of Sandersville, is interested in the promotion of an electric railway between Sandersville and Tennille, Washington County, three miles.

ATLANTA, GA.—Application will be made for a charter for the Atlanta Northeastern R. R. Co., which proposes to build an electric line to Cumming, via Roswell and Alpharetta. Survey is under way. The incorporators are T. F. Martin and J. L. Murphy, of Atlanta; J. I. Teasley, W. A. Lummus and J. P. Brooke, of Alpharetta; J. O. Crowley and C. C. Foster, of Roswell; C. L. Harris and W. R. Otwell, of Cumming, and F. C. Tate, of Jasper. Robt. P. Jones, Atlanta, is Atty. Capital stock, $50,000.

LEXINGTON, KY.—The Central Kentucky Traction Co. may build an electric railway from Lexington to Nicholasville, Ky., twelve miles following the Nicholasville turnpike. J. B. Crawford is Gen. Mgr., at Lexington.

SPRINGFIELD, OHIO.—Senator T. M. Berry, of Lima, Ohio, is reported to be promoting an electric railway to be constructed between Springfield and Saint Paris, Ohio.

FREMONT, OHIO.—The Fremont City Street Ry. Co. has been granted an amended franchise which will permit the company to extend its lines and build the belt around the city. The franchise is for a period of 25 years. Part of the work must be completed by Jan. 1, 1909. J. J. Anderson is Vice-Pres.

TOLEDO, OHIO.—Gen. J. Kent Hamilton, George A. Bassett, George P. Kirby, W. L. Rowland and W. S Thurston, Jr., all of Toledo, are interested in plan to build an electric railway to connect Columbus, Marion, Upper Sandusky and Toledo.

STEUBENVILLE, OHIO. — Right-of-way has been secured by the Steubenville & Canton Elec. Ry. Co. for the proposed traction line which is to connect these cities. T. H. Loomis, of Steubenville, is Ch. Engr.

GARY, IND.—Frederick H. Wood, Treas. of the Co-Operative Construction Co., Majestic Bldg., Chicago, advises us that this company has completed arrangements whereby sufficient capital is guaranteed to rapidly construct and complete the remaining lines of street railway in Gary, known as the Gary & Interurban Ry. Power plant has been completed and the lines on Broadway have been put in operation. This additional capital is for the purpose of extensions on Fifth and Eleventh Aves., to connect with East Chicago and Tolleston. A new Board of Directors has been elected as follows: Pres., F. N. Gavit, Whiting, Ind.; Vice-Pres., F. C. Raff, South Bend, Ind.; Geo. H. Ross, Vice-Pres., Chicago & Alton and also Vice-Pres. of the Toledo, St. Louis & Western R. R.; A. C. Miller, Pres. of the Chicago-New York Electric Air Line R. R. Co.; J. D. Price, Pres. of the Co-Operative Construction Co. C. W. Chase is Secy. and Treas., Chicago.

DETROIT, MICH.—It is planned to build an electric railway between Windsor, Ont., Lake Erie, and Detroit. The promoters are Dr. J. A. Smith, collector of customs for Windsor, Ont.; George Boutellier, collector of inland revenue for Walkerville, Ont.; Dr. Revell, A. J. Nelles, G. J. Leggatt and Walter Boug, all of Windsor, Ont., and George King, of Detroit. Mr. Leggatt is Atty.

HAMILTON, IOWA.—The Chicago, Ottumwa & Western Ry. Co. has made preliminary arrangements for building its line. It will connect Hamilton, Ottumwa and Des Moines and will be about 90 miles long. The officers are: T. J. Avery, Hiteman, Iowa, Pres. and Secy.; S. P. Pascoe, Hamilton, Vice-Pres.; A. A. McGarry, Hamilton, Treas.; John A. Nelson, Hamilton, is Ch. Engr. Noted on May 7.

VINELAND, MINN.—A. P. Jorgensen, Wm. Anderson, E. E. Dinwiddie and John Faught are interested in a plan to secure the construction of an electric railway between Vineland, Minn., and Onamia.

MINNEAPOLIS, MINN.—The Twin City Underground & Elevated Elec. Ry. Co., it is announced, has been incorporated in Minnesota to build an underground electric railway from Minneapolis to St. Paul. The estimated cost of the road is $6,000,000, and the time required to build, three years. A subway eleven miles long will be built of steel and concrete. The company will apply for franchises to operate the road. Capital stock, $50,000. Officers: George Norris, Pres. and Treas., William G. Stewart, Vice-Pres. and Engr.-in-Charge; Jay W. Crane, Secy. Temporary offices, 908 Guaranty Loan Bldg., Minnesota.

CHANUTE, KAN.—The Chanute Elec. Ry. Co. has been organized to build and operate a 10-mile electric railway in and about Chanute. A franchise was recently granted. It is expected to begin construction work soon. Capital stock, $300,000. Directors: L. H. Phillips, Girard, Kan.; S. W. Brewster, H. B. Farrelly and W. D. Kennedy, of Chanute.

OMAHA, NEB.—The Omaha & Nebraska Central Ry. Co. has commenced construction of its overhead trolley line from Omaha to Hastings, via David City, 160 miles. H. C. Long is Pres., 617 Tremont Bldg., Boston, Mass.; Anthony Texter, David City, Neb., is Vice-Pres.; C. H. Deeter, Omaha, Secy.; Eldon R. Long, David City, Treas.; W. H. Fuller, Hastings, Neb., Ch. Engr. Headquarters, 320 First National Bank Bldg., Omaha. Noted on Dec. 12, 1907.

BILLINGS, MONT.—Construction will be started soon by the Stillwater Power & Ry. Co., which was recently incorporated in Montana to build an electric railway from Billings to Cooke City, Mont., via Columbus, with branches into Yellowstone, Sweet Grass, Carbon and Park Counties. Capital stock, $3,000,000. Incorporators: Willard Bennett, Helena, Pres.; George H. Savage, W. E. Defresse and E. E. Congdon, Butte, Mont. Noted on May 7.

TEMPLE, TEX.—This town has subscribed $30,000 in the interests of an electric railroad to be built to connect Waco, Temple and Marlin. Among those interested in the proposition are: Mayor William Ginnuth, C. W. Wilson, Pat Cheeves, A. Lee Brown, A. J. Jarrell, Wm. Ginnuth, F. B. Slagle, F. F. Downs, R. O. Culp, A. L. Flint, J. S. Perry, A. H. Mayler and W. C. Knight, all of Temple.

BROWNWOOD, TEX.—W. S. Walker, of Granbury, has applied to the Council of Brownwood for a franchise for a street railway.

TACOMA, WASH.—The Pacific Traction Co. is surveying a line for an extension from American Lake to Olympia. A. E. Rothermel is Secy., Provident Bldg., Tacoma.

VANCOUVER, WASH.—The Vancouver Traction Co. will construct an electric railway in Clarke County from Vancouver to Fisher and Washougal. The incorporators are E. M. Rands, Vancouver; W. J. Patterson, Baker City, Ore., and A. Welch, Fenton Bldg., Portland. This company takes over the interests of the Washington Railway & Power Co., which was formed by W. H. Moore and his associates, and will finish construction of the work already started. The board of trustees of the new company is composed of Harrison Allen, Bert Yates, W. J. Patterson, A. Welch and E. M. Rands. Mr. Welch is Gen. Mgr. of the Northwestern Gas & Electric Co., of Walla Walla, Wash., and also Gen. Mgr. of the Portland, Eugene & Eastern Ry. Co., Portland.

VENTURA, CAL.—The Ventura Terminal Ry. Co. is making arrangements for the construction of its railway. As previously noted, Julian P. Jones, Mgr. of the Ventura Terminal Ry. Co., 506 Citizens' National Bank Bldg., Los Angeles, Cal., advises us that "this company proposes to build an electric railway to the cement rock quarry, a distance of 25 miles; also a 5-mile branch line to Nordhoff and the Ojai Valley. Preliminary surveys are made. Right-of-way is practically secured and capital is partly obtained. Contracts will be let when financial conditions are improved. This railway line is to be built in connection with a cement factory to be built at Tidewater, which will have a daily capacity of 2,000 bbls. Both enterprises will be owned and financed by the Ventura Industrial & Securities Co. Bonds will be sold." Wm. A. Ramsey is Ch. Engr., I. W. Hellman Bldg., Los Angeles.

SAN FRANCISCO, CAL.—The Scott Creek Ry. Co. is reported to have been incorporated in California to build a line 2¼ miles long from a point on the Ocean Shore Railway, at the Scott branch, to the San Vicente grant. Capital stock, $50,000. Directors: J. Downey Harvey, John B. Rogers and Bert Corbet.

STOCKTON, CAL.—The Central California Traction Co. will extend its lines to Sacramento, and probably to Modesto. Company operates ten miles of electric railway in Stockton, also a 14-mile branch to Lodi. Walter Arnstein is Gen. Mgr., 347 Grant Ave., San Francisco.

LOS ANGELES, CAL.—A company will be organized soon to build and operate an incline cable railway operated by electricity to the top of Mount Washington. The railway will be 3,000 ft. in length and will connect with the local street railway system. The promoters have applied to the Council for a franchise. A. St. Clair Perry, 140 West Fifth St., Los Angeles, is interested.

ST. THOMAS, ONT.—The St. Thomas St. Ry. Co. will extend its line to Port Stanley, about ten miles distant. A. S. Balsdon is Gen. Mgr. This railway is owned and operated by the city.

WINDSOR, ONT.—See "Detroit, Mich."

LIGHT AND POWER PLANTS.

(* *denotes that this work is advertised in Engineering News.*)

NEW YORK, N. Y.—Bids are asked until 11 a. m., July 27, by C. B. J. Snyder, Supt. School Bldgs., Dept. of Education, for installing electric equipment in Public School No. 54, on the east side of Walworth St. and the west side of Sanford St., about 112 ft. south of Myrtle Ave., Boro. of Brooklyn.

*CRANFORD, N. J.—Bids are asked by the Township Committee until 8 p. m., Aug. 5, for street lighting in the Township of Cranford. James E. Warner is Township Clerk.

WILKES-BARRE, PA.—Bids are asked until July 20 by J. M. Norris, County Controller, for a motor generator and static transformer equipment to be installed in connection with the electrical power and light equipment in Luzerne County Court-House. McCormick & French, Second National Bank Bldg., Wilkes-Barre, are Archs.

UNIONTOWN, PA.—The WEST PENN ELECTRIC CO., of this city and Connellsville, Pa., has been awarded the contract for furnishing the city with light for 165 street lamps at $70 each a year. The contract runs for a period a period of three years and seven months from June 1 last.

LAUREL, MD.—William E. Gilbert, Mayor, has appointed Mr. C. L. Reeder, Equitable Bldg., Baltimore, Engineer-in-Charge of the work on the electric plant which will be built here within the next few months. Mr. Reeder's appointment has been confirmed by the Council.

TAKOMA, D. C.—Bids are asked until Aug. 6 by Capt. H. L. Petteus, Q. M., for electric wiring and electric lighting fixtures, plumbing and gas-piping for one double set hospital corps sergeants' quarters, structed at Walter Reed Army pital, Takoma Sub-station, Wash

HUNTINGTON, W. VA.—The the laying of about 100 miles line from this city to Cincinna been awarded to the JAMES G CO., 4 Smithfield St., Pittsbu line will be built for the Co Electric Co., of New York C be completed this year if po will be started at once. The TUBE CO., Frick Bldg., Pittsb been awarded the contract for iron pipe that will be used in line.

AUGUSTA, GA.—The August & Electric Co. will expend abou additional machinery, which w generator of about 350-HP., a house in Augusta. J. H. Adams Engr.

JONESVILLE (Troy post-off The Birmingham Railway, Ligh Co., M. Sloan, Ch. Engr., Birmi has purchased a site in Jonesvil it will erect a proposed power-h $1,500,000.

KNOXVILLE, TENN. — The Power Co. has decided to proce plan for developing the water-p erty on the Little Tennessee Riv south of Knoxville. It will bui electric plant to transmit 30,000 H tricity for power and lighting. W OLIVER, of Knoxville, Tenn., pany's contractor and is also fin terested. Pressey & Weiler, H Washington, D. C., are Engrs. for pany. According to the "Manu Record", the company's officers ar H. Treat, of Washington, D. C., P T. Wilder, of Knoxville, Tenn., George H. Sullivan, of Cromwell & New York, Secy.; R. W. Austin, ville, Tenn., Res. Dir.; F. J. F Washington, D. C., Treas. The Knoxville Power Co. are in the Metropolitan Bank Bldg., Washington, D. C. The company is capitalized at $2,500,000.

MORGANFIELD, KY.—The Morganfield Light & Power Co. is planning to install a 100-KW., 550-volt, direct-current generator in the fall to furnish electricity for motor service, both alternating-current and direct-current. F. W. Gilbert is Mgr.

GALLIPOLIS, OHIO.—Samuel Hannaford & Son, Hulbert Block, Cincinnati, have finished plans for a power-house for the Ohio Hospital for Epileptics, Gallipolis.

INDIANAPOLIS, IND.—The Citizens' Gas Co. has awarded to the KERR-MURRAY MFG. CO., of Fort Wayne, Ind., the contract for the construction of a gas holder of 1,000,000 cu. ft. capacity, and one of 20,000 cu. ft. capacity, as a relief holder for the water gas set, which is to be constructed as a reserve plant of the company. Contract price, about $57,000. George Summers is Gen. Supt and Gas Engr.

ELGIN, ILL.—The contract for the construction of a sub-station for the Aurora, Elgin & Chicago R. R. Co., to be located on Grove St., has been awarded to L. E. PALM, of Elgin, for $13,900. E. C. Faber is Gen. Mgr., Wheaton, Ill.

MADISON, WIS.—Bids are asked by Lew F. Porter, Secy. Wisconsin Capitol Comn., until July 21 for building the boiler chimney at the heat and power plant now building.

ATLANTIC, IOWA.—J. L. Darnell, Engr., Kansas City, Mo., is preparing plans for an addition to the municipal lighting plant. T. E. Nichols, Atlantic, is Gen. Mgr.

FORT SCOTT, KAN.—The Fort Scott Gas & Electric Co. contemplates making extensive improvements to its system this summer, including the erection of 16 miles of transmission lines and the installation of a generator to supply electrical energy for the street car service. F. D. Martin, Fort Scott, is Mgr.

GREAT FALLS, MONT.—The Ryan-Moroney Syndicate has secured the capital stock of the Great Falls Water, Power & Townsite Co., owning valuable lands, buildings, water power, etc., at this city. The new owners will develop the falls of the Missouri River here.

SAN FRANCISCO, CAL.—The Consumers' Light & Power Co. has let contracts for machinery and electric equipment for a direct-current central station plant, to be installed in the basement of the Whitney Building on Geary St., as follows: For four engines with a total of 750 HP. to HUNT, MIRK & CO., 605 Howard St.; four 220-volt generators to the WESTINGHOUSE ELECTRIC & MFG. CO., Second and Howard Sts., San Francisco; for boiler plant, including five large boilers, to CHARLES MOORE & CO., 63 First St.

ESCONDIDO, CAL.—The Escondido Mutual Water Co. is considering a project to utilize the water of its reservoir to generate electricity. It is proposed to locate the plant at a point below the dam where a fall of about 450 ft. can be obtained. The water will be used for irrigation purposes afterward. The cost is estimated at $30,000. The plant will furnish electricity for lamps and motors to the entire valley. J. L. Van Deusen is Secy.

TWIN FALLS, IDAHO. — The Shoshone & Twin Falls Water & Power Co. will build a hydro-electric plant with an output of 37,000 KW. and will erect a 60-mile transmission line. D. C. MacWatters, of Milner, Idaho, is Mgr.

PACHUCA, MEXICO.—The WESTINGHOUSE ELECTRIC & MFG. CO., Pittsburg, Pa., has a contract to supply machinery to the Negociacon Minera de San Rafael Anexas, a Mexican mining company which operates in and about Pachuca, Mexico. The order calls for approximately 40 electric motors, averaging 100 HP. each, with transformers, motor panels, high and low tension switchboards, circuit breakers and lamps. The apparatus is to be used in the equipment of a new 60-stamp mill and for the operation of other machinery at the mines.

BRIDGES.

(* denotes that this work is advertised in Engineering News.)

WOON[illegible]KET, R. I.—A bridge will be constructed over the Blackstone River at Sayles[illegible] near River St. Estimated cost, $10,000.

NEW [illegible]RK, N. Y.—The following are the bids opened on June 23 by Louis F. Haffen, Pres. Boro., for constructing an extension to the Broadway bridge over the Bronx River at 177th [illegible]: (A) McHarg-Barton Co., 165 Broadway, New York; (B) Phoenix Construction Co., Park Row, New York; (C) F. V. Smith, East 125th St., New York; (D) H. E. [illegible], 1987 Madison Ave., New York; (E) The Halsey [illegible] E. Vermilye, Zerega Ave. and Prospect [illegible], New York; (F) LEAHY CONTRACTING & CONSTRUCTION CO., 1446 (G) Hol[illegible]erty Contracting Co., 215 West 125th St., New York; (H) Cooper & Evans, 220 Broadway, New York. (A) $93,701; (B) $78,137; (C) $59,638; (D) $62,798; (E) $54,207; (F) $53,810; (G) $56,432; (H) 59,669.

HACKENSACK, N. J.—Bids are asked by the Board of Chosen Freeholders, Bergen County, until 4 p. m., July 24, for constructing a bridge over the Hackensack River between Railroad Ave., Ridgefield Park and Riverside Pl., Hackensack. Specifications are on file at office of Engineering News, New York.

NEW CASTLE, PA.—Bids are asked until noon, July 21, by the County Commissioners, for raising the West Wurtemburg bridge, over the Connoquenessing Creek, and building up the abutments.

BRADFORD, PA.—Bids are asked until July 20 by Edward R. Charlton, City Clk., for constructing a steel bridge over Kendall Creek on East Main St. A. F. Bannock, Jr., is City Engr.

*PHILADELPHIA, PA.—Plans and specifications are on file at the office of Engineering News, New York, for the construction of bridges under Schedule A. Bids are asked until July 24.

PHILADELPHIA, PA.—The CHARLES McCALL CO. has been awarded the contract for constructing a foot bridge connecting the Philadelphia & Reading R. R. Co.'s Atlantic City station at the foot of Chestnut St. with the elevated railroad on Delaware Ave.

KNOXVILLE, TENN.—The Board of Public Works has instructed S. D. Newton, City Engr., to prepare new plans at once for the construction of the Vine Ave. viaduct.

*BENTON, TENN.—Bids are asked by the County Court Clerk until noon, Aug. 3, for the construction of three steel highway bridges in Polk County. Separate bids will be received for the substructures of all bridges complete, and for the superstructure of each bridge separately. The concrete work aggregates about 2,000 cu. yds. and the steel about 45,000 lbs. Plans and specifications are on file at office of Engineering News, New York.

CINCINNATI, OHIO.—Bids are asked until noon, July 31, by the Board of Public Service for bridge construction at Eighth St. John J. Wenner is Clk. Bd.

*SPRINGFIELD, OHIO.—Bids are asked by the Board of Public Service, at the office of the Clerk of the Board, Room 5, City Bldg., until noon, July 28, for furnishing the necessary labor and material for constructing a bridge across Buck Creek and the Anstead-Burk Co. head race at Sherman Ave. and Nelson St. Plans and specifications may be examined at the office of the Department of Public Service. William H. Mahoney is Clk. Bd.

UHRICHSVILLE, OHIO.—The contract for constructing a bridge over Stillwater Creek has been awarded to W. M. BRODE & CO., of New Comerstown, Ohio, at $20,798. Clyde J. Knisely is County Surv.

JEFFERSON, OHIO.—Bids are asked until 1 p. m., July 20, by P. C. Remick, County Audr., for constructing concrete abutments for the bridge over the east branch of Ashtabula Creek, Pierpont Township.

DELPHOS, OHIO.—Bids are asked by the County Commissioners until noon, Aug. 3, for the construction of a bridge over the Miami and Erie Canal at Third St. W. H. Troup is County Audr.

PORTSMOUTH, OHIO.—Bids are asked until noon, July 22, by Fred N. Tynes, County Audr., for the construction and completion of iron or steel superstructures for several bridges.

DANVILLE, IND.—The HACKEDORN CONTRACTING CO., of Indianapolis, Ind., has been awarded contracts for the construction of the following reinforced concrete bridges in Hendricks County: One double 75-ft. arch bridge at Plainfield; one 90-ft. bridge near Danville; one 30-ft. bridge near Cartersburg. Other bidders were: National Bridge Co., W. C. Halstead & Co., Attica Bridge Co., Indiana Bridge Co., and LaFayette Engineering Co. Although the bids for steel bridges were much lower than the reinforced concrete arches, the County Commissioners selected the concrete construction. The bridges were designed by The Block Bridge & Supply Co., of Indianapolis.

FORT WAYNE, IND.—Bids are asked by the Commissioners of Allen County until 10 a. m., July 29, for the construction of a bridge, 171 ft. long; for changing a steel bridge 117 ft. long from a 20-ft. roadway to a 16-ft. roadway; concrete piers for same; also for five concrete culverts and five abutments. G. W. Lindemuth is County Audr.

IRONWOOD, MICH.—The HENNEPIN BRIDGE CO., of Minneapolis, Minn., has secured the contract for constructing a steel bridge across the Montreal River between Ironwood, Mich., and Hurley, Wis., at $5,700.

MARSHALL, MICH.—Plans have been prepared for the construction of a single arch, 60-ft. bridge for this city. Estimated cost, $7,200.

FREMONT, MICH.—JENKS & DRESSER, Port Huron, Mich., have been awarded contracts for the construction of a 30-ft. bridge and a 20-ft. bridge in Wilcox Township.

SIOUX CITY, IOWA.—The Deputy City Engineer has prepared plans for the construction of a steel span bridge over Main St. and for a concrete culvert for Linn Ave., 66 ft. long.

DULUTH, MINN.—The Council has ordered the expenditure of $41,000, the sum of $30,000 is for bridge repair, rebuilding and strengthening, and the remainder for street improvements.

The Duluth-Superior Traction Co., of Duluth, is contemplating the construction of a viaduct at Lamborn Ave.

OMAHA, NEB.—The STANDARD BRIDGE CO. has been awarded the contract for constructing and repairing wooden pile bridges for the county.

HELENA, MONT.—Bids are asked by Percy R. Witmer, County Clk., until noon, July 22, for the removal of the present partially wrecked bridge over Prickly Pear Creek on Main St., and its transportation and erection at Front St. and other bridge work.

KANSAS CITY, MO.—The City Engineer has submitted estimates of the cost of constructing a bridge across Blue Valley at Independence Ave. as follows: For a steel bridge, 200 ft. long and 18 ft. wide, with concrete paving and approaches, $24,500; with timber flooring, trusses and approaches, $16,000.

The MIDLAND BRIDGE CO., has secured the contract, at $7,047, for constructing a reinforced concrete arch and masonry bridge over Heart Grove Creek on Holmes Park Road for the county.

AUSTIN, TEX.—Bonds have been voted by Travis County for the construction of a reinforced-concrete bridge across the Colorado River at the foot of Congress St. Estimated cost, $200,000.

RALSTON, OKLA.—The Ralston Bridge & Improvement Co. has been incorporated with capital stock of $6,000. The incorporators are: E. A. Bullock, V. D. Ebedwein and E. Cook.

OROFINO, IDAHO.—P. H. Blake and others contemplate constructing a steel bridge over the Clearwater River here. Plans call for a steel and wood structure. Estimated cost, $25,000.

BUILDINGS.

(* denotes that this work is advertised in Engineering News.)

NEW BEDFORD, MASS.—We are officially advised that the Committee on City Property which received bids for the alteration of the library building into a municipal office building on June 10, has awarded contract to JOHN B. SULLIVAN & SON, New Bedford, Mass. Samuel C. Hunt, Odd Fellows' Bldg., is Arch.

FALL RIVER, MASS.—The following bids have been received by John T. Coughlin, Mayor, for buildings for the contagious hospital, consisting of a 3-story brick and stone administration building: A laundry and boiler room, a domestic building and two wards: Mitchell Nicholson, $92,300, $161,683; James A. Donnelly, 225 Bedford St., $64,250, $144,079; Beattie & Cornell, 33 North Quarry St., $92,000, $161,500; Patrick Corrigan, 4 Morgan St., $83,429, $145,290; Arthur Puleston, $78,800, $62,000; Beattie & Wilcox, 840 Bedford St., $86,916, $192,170; William A. Borden, 380 Second St., $92,400, $157,500.

HAVERHILL, MASS.—Bids are asked until 7.30 p. m., July 21, by the High School Building Commission, for the erection of a high school building to be erected at Main and Summer Sts. Kilham & Hopkins, 9 Park St., Boston, Mass., are Archs.; W. W. Roberts is Clerk of the Comn.

NEW YORK, N. Y.—Bids are asked until 10 a. m., July 24, by Theodore A. Bingham, Police Comr., for furnishing all the labor and materials and making and completing alterations, general repairs and improvements to the 13th, 14th, 36th and 40th Precinct station houses, etc., Boro. of Manhattan; the 149th and 165th Precinct station houses, etc., boro. of Brooklyn, and the 274th and 276th Precinct station houses, etc., Boro. of Queens.

Bids are asked at the same time by Theodore Bingham, Police Comr., for erecting all the materials necessary to build and complete the new station house, prison and stable for the Second Precinct, on the west side of Greenwich St., 79 ft. 5¼ ins. south of Cortlandt St., at 156 and 158 Greenwich St., running through to and including 163 and 165 Washington St.

Plans have been filed with the Building Superintendent for the improvement of 131 and 133 West 28th St., by the erection of a 7-story loft and store building to be put up by the Tarrytown Building Co., John A. Walker, Pres. It will have a frontage of 53 ft. and a depth of 93 ft. with an extension and the facades will be of brick trimmed with terra cotta and limestone and having large mezzanine bays set between Doric pilasters. The bays will have arches at the second and sixth stories. The building is to cost $100,000. Louis A. Hornum is Arch.

NEW YORK, N. Y.—We are advised by Bannister & Schell, Archs., 60 Wall St., that plans have been filed for the improvement of the irregular plot at 25 to 29 Beekman St., extending through the block to 57 and 61 Ann St., with a 12-story commercial building, to be erected by the Nassau-Beekman Co., Robert Ralston Reed, Pres., 55 Liberty St. The structure will have frontages of 53 ft. on Ann St. and 67.11 ft. on Beekman St., and will be 239 ft. deep, with an extension, 63.8 x 56.9 ft. It will be equipped with a full power plant for manufacturing. The building will cost about $750,000. Estimates will be taken in about six weeks.

Sommerfeld & Steckler, Archs., 19 Union Sq., advises us that the general contract for constructing a 10-story brick and stone loft building at 138 West 17th St., for the Washington Arch Realty Co., on premises, has been let to WILLIAM J. TAYLOR, 7 East 42d St. The building will be 42.2 x 85 ft. and will cost $110,000.

We are officially advised that the Washington Heights Development & Construction Co., 103 Park Ave., is taking estimates for construction of a 6-story apartment house to be erected at Audubon Ave. and 177th St. The building will be 85 x 100 ft., and will cost $250,000. Mulliken & Moeller, 103 Park Ave., are Archs.

NEW YORK, N. Y.—Bids are asked until 3 p. m., July 23, by Henry Smith, Pres. Park Bd., for furnishing and installing new steam supply and return mains and other work in connection therewith for the menagerie buildings in Central Park, opposite East 64th St., Boro. of Manhattan.

We are advised by Moore & Landsiedel, Archs., 2810 Third Ave., that Lorenz Werher, 76 East 86th St., has let masonry contracts for constructing a 6-story apartment, 100 x 88 ft., as follows: Stone, G. DEL GAUDIO, 1548 St. Lawrence Ave.; brick, E. WATERS, 164th St. and Ogden Ave., Estimates on other work are being taken. Estimated cost, $125,000.

Plans have been filed for a 6-story hotel which is to be erected on the property owned by Conrad Stubenbrod on Surf Ave., Coney Island. The plot on which the building is to be erected is 100 x 150 ft., fronting on Surf Ave., and with one side part of the entrance to Dreamland.

Warren & Wetmore, Archs., 3 East 33d St., have filed plans with the Building Superintendent for the proposed 14-story Ritz-Carlton Hotel to be erected for Robert Walton Goelet on the block on the west side of Madison Ave., from 46th to 47th Sts. It is to have an avenue frontage of 200 ft. and a depth of 140 ft. on either street. It will be of brick with ornamental stone trimmings, elaborately decorated in the modern Renaissance style. Estimated cost, $2,000,000.

Ernest Greene, Arch., 5 Beekman St., advises us that bids will be received the latter part of July for erecting a 10-story brick fireproof building for the New York Press Club. The structure will measure 62 x 36 ft. and will cost $90,000.

NEW YORK, N. Y.—Bids are asked by the Park Board, Henry Smith, Pres., until 3 p. m., July 30, for the erection and completion of an Administration Building in the New York Zoological Park, in Bronx Park, in the City of New York.

Bids are asked until 11 a. m., July 24, by Henry H. Sherman, Chn. Executive Com., Dept. of Education, for (a) new plastic slate roofs, (b) new metal ceilings, painting, etc., at the Normal College, Park and Lexington Aves., 68th and 69th Sts., Boro. of Manhattan.

Bids are asked until 10 a. m., July 29, by the Board of Health, Dr. Thomas Darlington, Pres., for furnishing and installing two new boilers, together with all necessary alterations and other work incidental thereto in the boiler house on the grounds of the Kingston Ave. Hospital, at Kingston Ave. and Fenimore St., Boro. of Brooklyn, City of New York.

NEW YORK, N. Y.—Bids are asked until 11 a. m., July 27, by C. B. J. Snyder, Supt. School Bldgs., Dept. of Education, for the general construction, etc., of additions to and alterations in Public School No. 84, on the south side of Glenmore Ave., between Watkins St. and Stone Ave., Boro. of Brooklyn; for installing heating and ventilating apparatus in new Public School No. 93, on the southeast corner of Herkimer St. and New York Ave., Boro. of Brooklyn; for alterations, repairs, etc., at Public School No. 26, Andrews and Burnside Aves., Morris Heights, Boro. of the Bronx; for repairs to heating and ventilating apparatus in Public School No. 77, First Ave. and 85th St., Boro. of Manhattan; for alterations, repairs, etc., to Jamaica Training School, Bryant High School and Public Schools Nos. 4, 9, 12, 15, 26, 27, 31, 37, 49, 50, 53, 54, 57, 59, 75, 76, Boro. of Queens.

HUNTINGTON (L. I.), N. Y.—Adden & Parker, Archs., 12 Bosworth St., Boston, Mass., advise us that bids will be received about July 20 for a 3-story high and grammar school, for which $80,000 has been appropriated by the Huntington Board of Education.

CANANDAIGUA, N. Y.—J. Foster Warner, Arch., Granite Bldg., Rochester, N. Y., has let general contract to A. W. HOPEMAN SONS & CO., 569 Lyell Ave., Rochester, at $96,948, for remodeling and building addition to the court-house for the Board of Supervisors, Canandaigua.

AUBURN, N. Y.—Contract has been let by Samuel E. Hilliger, Arch., Seward Bldg., to DAWSON BROS., Kirk Bldg., Syracuse, N. Y., for a 2-story and basement press brick and stone-trimmed high school building for the Board of Estimate and Control, Auburn. Cost, $114,000.

FORT HANCOCK, N. J.—We are officially advised that on July 6 the Quartermaster General, U. S. A., let contract to HARRY F. MURPHY & CO., 25 North Seventh St., Philadelphia, Pa., for installing heating apparatus in one Commanding Officer's quarters, six Captains' quarters, ten Lieutenants' quarters, one guard house and four barrack buildings. Capt. M. N. Falls is Constr. Q. M.

LATROBE, PA.—Dr. R. Eisman, of this city, has awarded the contract for the erection of the Eisman Building to EDWARD C. POLAND, of Latrobe, at $75,000. The building will be of brick and cut stone, four stories in height, 50 x 100 ft.; will have central power and electric plant, electric elevators and steam heating system. The right is reserved to add two additional stories when the building has reached the fourth story, and before the roof is started. The total cost of the four-story building, including sub-contracts, will be about $100,000. The heating, plumbing, power and elevator contracts will be awarded separately.

PITTSBURG, PA.—William Kennelly, 4928 Dauphin St., will erect 20 brick dwellings in the Belmar District, of which 16 will be built on Bennett St. and a row of four on Murtland Ave. The total cost will be about $45,000.

Thomas Hannah, Arch., Diamond Bank Bldg., will have plans ready about July 15 for the 6-story building for the Y. M. C. A., East Liberty. Cost, $300,000.

PITTSBURG, PA.—We are advised by Palmer & Hornbostel, 63 William St., New York, that general contract has been let to JAMES L. STUART, 341 Sixth Ave., Pittsburg, for the 4-story School of Mines building for the Western University of Pennsylvania, S. B. Lenhart, Secy. Bldg. Com., Pittsburg. Cost, $175,000.

Thomas Hannah, Arch., Diamond Bank Bldg., is preparing plans for a 3-story orphans' home for the Protestant Orphans' Home Association. The structure will cost $150,000.

NEW CASTLE, PA.—W. G. Eckles Arch., Lawrence Trust Bldg., New Castle, Pa., advises us that all bids have been rejected for constructing a 3-story fireproof high school, 200 x 175 ft., to cost about $200,000.

PHILADELPHIA, PA.—The contract for constructing three sets of officers' quarters at the Navy Yard, Philadelphia, Pa., under bids opened by the Quartermaster of the U. S. Marine Corps, on June 25, has been awarded to B. KETCHAM & SON, 1031 Brown St., Philadelphia, at $42,572.

WILKINSBURG (Pittsburg post-office), PA.—Competitive plans will be received until Aug. 1 by the Board of Education for constructing a fireproof brick and stone high school building to cost $200,000.

SHARON, PA.—Bids were received as follows July 14 at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of a post-office building at Sharon, Pa.: Willis & Carley Co., Sharon, Pa., $54,850; A. E. Badley, Binghamton, N. Y., $52,000; M. F. Wells, Philadelphia, $49,894; William Gray & Sons, Philadelphia, $46,950; John G. Unkefer & Co., Minerva, Ohio, $48,297; National Co., Cleveland, Ohio, $49,500; C. V. Beatty, East Liverpool, Ohio, $43,973.

HARRISBURG, PA.—The Harrisburg Public Library Association has appointed a committee to select plans for a library building, to be erected at Front and Walnut Sts. The size of the lot is 52½ x 210 ft. The building will cost about $40,000. The Committee is composed of Haldeman J. O'Connor, Chn., D. Bailey Brandt and James McCormick, Jr.

WASHINGTON, D. C.—The contract for the interior marble work for the U. S. Senate building has been let by Elliott Woods, Supt. U. S. Capitol Bldg. and Grounds, to the VERMONT MARBLE CO., of Proctor, Vt., at $200,571.

The following bids were received on July 2 for construction of an assembly hall for the Government Hospital for the Insane, Washington: The Brennan Construction Co., Washington, D. C., $99,801; with extension, $104,801; time, May 1, 1909. Pavarini & Wyne, Washington, D. C., $92,000; with extension, $96,000; May 15, 1909. Herman Probst, New York, $102,900; with extension, $107,900; May 1, 1909. Newman & Smith, Washington, D. C., $105,495; with extension, $109,975; April 1, 1909. The Thompson-Starrett Co., Washington, D. C., $97,785; with extension, $101,761; eight months.

RICHMOND, VA.—Bids are asked until July 27, for erecting a building in Richmond for the Y. M. C. A. The structure will be built at Seventh and Grace Sts., and will cost $180,000.

*PETERSBURG, VA.—Bids are asked by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p. m., Aug. 19, for an extension, remodeling, etc., including plumbing, gas piping, heating apparatus, electric conduits and wiring, to the U. S. post-office and custom-house at Petersburg.

LYNCHBURG, VA.—The Strother Drug Co. has awarded contract to ADAMS & JONES, of Lynchburg, for erection of the proposed office and store building. The building will have six stories and basement with front elevation finished in gray pressed brick. Cost, about $40,000.

MARIETTA, GA.—The following bids were received by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., on July 6 for the construction of the U. S. post-office at Marietta, Ga. Blue Ridge Construction Co., Asheville, N. C., $37,500, time as specified; S. J. Warner, Atlanta, Ga., $48,219; Hippman-Hayes Co., Atlanta, Ga., $49,975, July 1, 1909; Gude & Walker, Atlanta, Ga., $43,900, July 31, 1909; George B. Hinman, Atlanta, Ga., $46,621, time as specified; Miles-Bradt Co., Atlanta, Ga., $44,000, time as specified; W. J. Beeland, Macon, Ga., $87,743, July 31, 1909.

BIRMINGHAM, ALA.—A building to be about twelve stories high and to be known as the Jordan Bldg., will be built on a lot 100 x 140 ft. at the corner of Fifth Ave. and 20th St. The contract has been let to the STRUCT CONSTRUCTION CO., of Louisville, Ky.

Warren & Welton, Archs., Title Guarantee Bldg., Birmingham, will have plans for the proposed Chamber of Commerce building ready in about six weeks. It will be a 7-story structure, 100 x 100 ft., and 100 ft. high, of reinforced concrete construction, with terra-cotta cornice to two lower stories and light brick facing. Cost, $120,000.

COLUMBIA, TENN.—The following bids were received on July 2 by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for the construction of the U. S. post-office at Columbia, Tenn.: Blue Ridge Construction Co., Asheville, N. C., $48,623, time as specified; Barnes Bros., Hamilton, Ohio, $47,500, time as specified;

George Moore & Son, Nashville, Tenn., $43,-185, time as specified; Alfred Stuck Co., Louisville, Ky., $49,549, Aug. 1, 1909; James Trimby, Chattanooga, Tenn., $52,200; Miles & Bradt, Atlanta, Ga., $46,195, time as specified; F. M. Roody, Tifton, Ind., $46,978, Aug. 9; King Lumber Co., Charlottesville, Va., $42,950.

NEWARK, OHIO.—The general contract for constructing the proposed Arcade at Newark has been let to E. K. HIBBS of Columbus, Ohio, and the work will commence at once. The Arcade will be 400 ft. in length and will extend from Third to Fourth Sts., between Main and Church Sts., and will cost $48,000. It will be three stories high. The ground floor will have business rooms and the upper floors will be used for offices and living apartments. The work is being done under the direction of the promoters, the Newark Realty & Improvement Co. Howell & Thomas, of Columbus, are Archs.

CINCINNATI, OHIO.—Garber & Woodward, Archs., Neave Bldg., have finished plans and will take estimates for a 4-story and basement hotel for Cincinnati Union Bethel, James O. White, Supt. Cost, $50,-000.

FORT WAYNE, IND.—W. W. Rockhill, Secy., writes us that the general contract for constructing the Scottish Rite Cathedral to be erected in this city, was let on July 3 to TOM SNOOK, for $67,631; the iron and steel construction to the FORT WAYNE FOUNDRY & MACHINE CO., for $10,318; the stone work to WILLIAM GEAKE, for $30,409. The contracts for heating, lighting, decorating, art-glass and electrical fixtures will be let later. All contractors are of this city.

MUNCIE, IND.—Cuno Kibele, Arch., is preparing plans for a 3-story city hall. L. Guthry is Mayor. Cost, $125,000.

NEW CASTLE, IND.—The County Commissioners are preparing to build a public hospital in this city on North Main St.

DETROIT, MICH.—Bids are asked until July 18 by Harry J. Hill, Arch., for the construction of a combined church and school for the Roman Catholic parish of St. Hyacinthe, corner of Frederick and McDougal Aves. The structure will be two stories high, solid brick, with limestone trimmings, slate roof, structural steel frame, steam heating system. It will contain a kitchen, dining room, eight school rooms and commodious church, and will cost about $50,000.

ALTON, ILL.—Contract has been let by Barnett, Haynes & Barnett, Frisco Bldg., St. Louis, to the C. L. GRAY CONSTRUCTION CO., Victoria Bldg., St. Louis, for a 5-story hotel, to be built at Alton. Cost, $100,000.

CHICAGO, ILL.—Bids were received as follows July 10 at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for installing a vacuum cleaning system in the Chicago, Ill., post-office: Blaisdell Machinery Co., Bradford, Pa., $11,754; Chicago Pneumatic Tube Co., Chicago, $14,785; Sanitary Devices Mfg. Co., New York, $11,900; American Air Cleaning Co., Milwaukee, Wis., $12,557; Spencer Turbine Cleaner Co., Hartford, Conn., $15,751.

A site for a proposed Central Masonic Temple, to cost about $250,000, has just been purchased, at 208 to 304 La Salle Ave., by Harris W. Huehl, of Huehl & Schmid, Archs., Metropolitan Block, and Dr. Raymond L. Leonard. The land front 125 ft. and has a depth of 126 ft. The building will be four stories high.

MILWAUKEE, WIS.—Plans for an apartment building to be erected on the Lake Front at Mason St. and Juneau Pl., are being prepared by H. J. Rotier, Goldsmith Bldg., for Patrick Cudahy. The tentative plans provide for a 60-apartment building. The center of the structure will rise to a height of eight stories and the two wings will be four stories high. The front of the building is to be of white tile with pressed brick for the sides.

BURLINGTON, IOWA.—Bids are asked by D. S. Cooper, Secy. Bd. of Education, until July 30, for erecting a 2-story and basement high school building, 175 × 147 ft., for the Board of Education, Burlington. Temple, Burrows & McLane, McManus Bldg., Davenport, Iowa, are Archs. Cost, $130,000.

ST. PAUL, MINN.—Bids are asked by John H. Wheeler, Arch., New York Life Bldg., until Aug. 1 for construction of the superstructure of the dormitory, chapel and refectory buildings for the St. Agatha's Conservatory, Ninth and Cedar Sts. Cost, $75,-000. The contract for the excavation has been let to the GEORGE J. GRANT CONSTRUCTION CO., 61 East Ninth St.

BRAINERD, MINN.—Plans have been completed by Thori, Albon & Fisher, Archs., Chamber of Commerce Bldg., St. Paul, Minn., for a 3-story pressed brick and cut stone bank building for the Citizens' National Bank, Brainerd. It will have plate glass fronts, steam heating, electric lighting, tiled floors, etc. Cost, $40,000. M. J. Dunn is Pres.

MINNEAPOLIS, MINN.—Kees & Colburn, Archs., Kasota Block, have let general contract to J. L. ROBINSON, 205 South Seventh St., for a 2-story theater here for C. H. Miles, St. Paul, to cost $75,000.

ATCHISON, KAN.—Plans have been prepared by Sayler & Seddon, Archs., Kansas City, Mo., for a 3-story high school building for the Board of Education. The structure will cost $95,000.

BEATRICE, NEB.—We are officially advised that the contract for erecting the proposed high school building here has been let to the STANBERRY CONSTRUCTION CO., Stanberry, Mo. W. W. Duncan is Chn. Com. on Grounds and Bldgs.; R. W. Grant, Beatrice, is Arch.

ST. LOUIS, MO.—Barnett, Haynes & Barnett, Archs., Frisco Bldg., have prepared plans for a 4-story industrial school building for the St. Philomena Industrial School. Estimated cost, $150,000.

FAYETTEVILLE, ARK.—The contract for the erection of the government building here has been let by James Knox Taylor, Superv. Arch., Treasury Dept., to McIROY & BYRNES, of this city, at $46,300. The structure is to be of brick and stone and work on it will begin at once. Noted on July 2.

CONWAY, ARK.—The Conway School Board has decided to erect a brick school building which will cost about $40,000 when completed. Plans are now being drawn and work will begin at once.

SAN FRANCISCO, CAL.—Newton J. Tharp, City Arch., writes us that he is preparing preliminary plans and specifications for the following schools, etc.: Class A—Adams Grammar School, twelve rooms, estimated cost, $120,000; Denmar Grammar School, 16 rooms, $160,000; Franklin Grammar School, twelve rooms, $120,000; Hancock Grammar School, 16 rooms, $160,000; Jean Parker Grammar School, 16 rooms, $160,000; John Swett Grammar School, twelve rooms, $120,000; Jefferson Primary School, eight rooms, $80,000; Lincoln Grammar School, twelve rooms, $120,000; Oriental Public School, eight rooms, $80,000; Mission Grammar School, 16 rooms, $160,000; Irving Primary School, eight rooms, $80,000; Spring Valley Grammar School, twelve rooms, $120,-000. Total for Class A buildings, grammar and primary, $1,480,000.

Special construction.—Bryant Cosmopolitan Primary School, 16 rooms, $100,000; Clement Primary School, twelve rooms, $80,000; Cooper Primary School, 16 rooms, $100,000; Peabody Primary School, 16 rooms, $100,000; Holly Park Primary School, 16 rooms, $160,-000; Madison Primary School, twelve rooms, $80,000; Marshall Primary School, 16 rooms, $100,000; McKinley Primary School, 16 rooms, $100,000; Sheridan Primary School, 16 rooms, $100,000; South End Primary School, 16 rooms, $100,000; Grattan Primary School, 16 rooms, $100,000; Sutro Primary School, 16 rooms, $100,000; West End Primary School, twelve rooms, $75,000; Lakeview Primary School, 16 rooms, $100,000; Jackson Primary School, 16 rooms, $100,000; Cleveland Primary School, twelve rooms, $75,000; Starr King Primary School, 16 rooms, $75,-000; F. J. McCoppin Primary School, 16 rooms, $100,000. Total for special construction buildings, $1,685,000.

Class A high schools.—Girls' High School, 20 rooms, $450,000; Lowell High School, 20 rooms, $450,000; Commercial High School, 20 rooms, $180,000; addition to Mission High School, $150,000. Total cost of three high schools and addition, $1,240,000.

A Class A fireproof and earthquake proof group of hospital buildings, to be constructed on a lot 480 × 866 ft., bounded by Potrero Ave., 22d St., San Bruno Ave. and 23d St. The group is to consist of a 6 or 7-story main building, a group of pavilions for tuberculosis patients and a group of pavilions for infectious patients. The estimated cost of construction of the above buildings, with all necessary outbuildings and grounds, and the lands to be acquired, is $2,000,000.

A Class A fireproof and earthquake proof building or buildings to be constructed on Kearny St., between Clay and Washington Sts., to be used for Hall of Justice, County Jail, etc. The estimated cost of construction of the above building or buildings and lands is $1,000,000. Marsden Manson is City Engr.

The report of the City Architect to the Board of Public Works for all the above work is on file at the office of Engineering News, New York.

*LOGAN, UTAH.—Bids are asked until 3 p. m., Aug. 24, by James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., for construction, complete, of the U. S. post-office at Logan.

WINNIPEG, MAN.—The School Board has awarded the contract for the construction of the Cecil Rhodes School to DAVIDSON BROS., Tribune Bldg., Winnipeg, at $64,781. Work will be started immediately.

SASKATOON, SASK.—McDAIRMID & CO., Langside and Portage Sts., Winnipeg, Man., have secured the contract to construct the proposed civic hospital. Cost, $47,490.

VANCOUVER, B. C.—A. Calori will erect a 5-story and basement building on Pender St., to cost $110,000. It will be fireproof.

VANCOUVER, B. C.—Dalton & Everley, Archs., Davis Chamber, Vancouver, advise us that they have prepared plans for a 2-story wood and concrete consumptive sanitarium to be erected at Tranquille, at a cost of approximately $90,000, for the British Columbia Anti-Tuberculosis Society. Bids for construction will be called for in about a month.

WATER SUPPLY—IRRIGATION.

BROCKTON, MASS.—The Committee on Water awarded the contract on July 3 for furnishing pipe to the Water Department to the UNITED STATES CAST-IRON PIPE & FOUNDRY CO. at $24.20 a ton, f. o. b. Brockton. There are 100 ft. of 10-in., 200 ft. of 8-in. and 200 ft. of 6-in. pipe. This is 95 cts. a ton lower than the Committee paid in February. There were five bidders, that of the above being lowest.

PEPPERELL, MASS.—Bids for laying about 13½ miles of c.-i. water pipe, 6 to 12 ins. in diameter, are asked by the Water Commissioners until noon, July 21. George T. Keyes is Chn. Comrs. William S. Johnson, 101 Tremont St., Boston, Mass., is Engr.

*CONCORD, MASS.—The following bids were received on July 8 by Metcalf & Eddy, Engrs. for the Water Commissioners for laying c.-i. pipe and appurtenances and constructing a reservoir: Frank Williams & Co., 19 Willard St., Boston, Mass., $22,011; BRUNO & PETITTI, 18 Tremont St., Boston, $23,511 (awarded contract); Charles N. Taylor, Wellesley, Mass., $23,636; Auguste Saucier, South Framingham, $23,743; B. Perrini & Co., Ashland, Mass., $24,567; D. Cuozzo, 53 Park Row, New York, $25,527; The Loring N. Farnum Co., 53 State St., Boston, $26,360; M. McDonough, Swampscott, Mass., $27,571; Falvey & Kelly, 15 Intervale Park, Dorchester, Mass., $27,814; Long & Little Co., Leominster, Mass., $28,651; Coughlin & Sheils, 43 Tremont St., Boston, $28,842; Rowe Contracting Co., Melrose, Mass., $29,658; G. Louis Burnham, Andover, Mass., $30,605; Coleman Bros., 15 Court Square, Boston, $30,787; Charles G. Craib & Co., Winthrop, Mass., $31,564; Donovan & Phillips, 15 Beacon St., Boston, $41,669; M. Russo & Son, 240 North St., Boston, $49,984. Itemized prices will be given under Contract Prices next week.

BEDFORD, MASS.—Bids are asked until 7 p. m., July 16, by the Water Commissioners for constructing a storage basin, collecting well and filter in connection with the Bedford water-works.

EAST BROOKFIELD, MASS.—The citizens on July 1 voted in favor of appropriating $25,000 to construct a water supply system here. William S. Johnson, 101 Tremont St., Boston, Mass., is Engr.

*NEW BRITAIN, CONN.—We are officially advised that bids were opened on July 10 by the Board of Water Commissioners for laying about eight miles of water pipe: (a) Section 2 and (b) Section 3: James E. Bunting and Robert Bull & Co., Inc., New York, (a) $25,711, (b) $27,105; Henry E. Fox, New York, (a) $37,047, (b) $31,745; J. Edward Tracy, Derby, Conn., (a) $27,180; Richard W. Sherman, Utica, N. Y., (a) $35,-616, (b) $35,326; Long & Little & Co., Leominster, Mass., (a) $27,246, (b) $24,969; Donato Cuozzo, New York, (a) $28,499; James H. Ferguson, Dorchester, Mass., (a) $34,780, (b) $29,089; Falvey & Kelly, Dorchester, Mass., (a) $25,003; J. H. Clements & Son, Schenectady, N. Y., (a) $51,511; Fred S. & A. D. Gore Corporation, Dorchester, Mass., (b) $27,605. Contract for Section 2 will probably be awarded to Falvey & Kelly, and for Section 3 to the Long & Little & Co. H. D. Humphrey is Chn. Bd.

*WARWICK, N. Y.—Bids are asked by the Board of Water Commissioners until July 21 for the construction of a storage reservoir. C. S. Lazear is Village Clk.

FT. WOOD, N. Y.—Bids are asked by G. C. Burnell, Constructing Q. M., U. S. A., until 10.45 a. m., Aug. 3, for lowering water pipe at this post.

CORTLAND, N. Y.—The citizens on June 30 voted to purchase the plant of the Cortland Water-Works Co. E. G. Ditton is City Clk.

OWEGO, N. Y.—The contract for the construction of the reservoir to be built for the Owego Water-Works Co. has been let to the P. B. McGAGHEY CO., of Little Falls, N. Y., at $10,000. The reservoir will be situated northeast of the village on the E. H. House property. The capacity will be over 1,600,000 gallons.

MECHANICSBURG, PA.—The town is contemplating the installation of a water plant which will cost about $250,000. The plant is expected to furnish water to a dozen towns.

*PHILADELPHIA, PA.—Bids are asked until noon, July 29, by George R. Stearns, Dir. Pub. Wks., for Contract No. 149, extension of fire main system; Contract No. 145, curbing on Robbins St. and Delaware Ave.; Contract No. 146, restoring sand to the Belmont, Upper and Lower Roxborough and Torresdale filters; Contract No. 147, sluice-gates for the Torresdale filter plant; Contract No. 148, furnishing 48-in. c.-i. pipe and specials; Contract No. 149, painting buildings at the Upper and Lower Roxborough and Belmont filters; Contract No. 150, surface condenser for the Roxborough auxiliary pumping station; Contract No. 151, furnishing 6, 8 and 10-in. c.-i. pipe and special castings.

READING, PA.—We are officially advised that bids were received as follows on July 10 by the Board of Water Commissioners for the construction of slow sand filters for Bernhart water supply: David Peoples, Philadelphia, Pa., $83,495 (filter house faced with granite) and $81,511 (faced with Indiana limestone); JOHN F. ALBRECHT and ADAM H. LEADER, Reading, Pa., $75,317 (awarded contract) and $72,080; Millard Construction Co., Philadelphia, $87,599 and $84,299; H. E. Ahrens Co., Reading, $81,864 and $78,624; Blackstaff Engineering Co., Philadelphia, $97,598 and $91,873; Bennis Construction Co., Philadelphia, $94,605 and $92,229; Robert C. Storrie, Philadelphia, $74,318 and $73,818; William Nolan, Jr., Smoking Springs, Pa., $90,184 and $87,311; S. W. Chiles, South Bethlehem, Pa., $81,-069 and $79,169; L. H. Focht & Son, Reading, $85,038 and $81,652; New York Continental Jewell Filtration Co., New York, $92,-758 and $90,758; James E. Bunting and Roberts, Bull & Co., $74,909 and $71,510 (Roberts, Bull & Co., a corporation, did not affix their corporate seal to the bid nor the bond); Fehr & O'Rourke, Reading, $80,821 and $78,-339. Lincoln S. Ramsey is Secy. Bd. Itemized prices will be given under Contract Prices next week.

*DANVILLE, PA.—Bids are asked until noon, Aug. 13, by W. F. Shay, Pres., care of Dr. H. B. Meredith, Supt., Danville, for addition to the building and mechanical filter plant of the State Hospital for the Insane at Danville.

ANNAPOLIS, MD.—Bids are asked until July 22 for enlarging the water plant at the U. S. Naval Academy. Truman H. Newberry is Acting Secretary, Navy Dept., Washington, D. C.

*WASHINGTON, D. C.—Bids are asked until noon, Aug. 1, by the Commissioners of the District of Columbia for furnishing c.-i. water pipe specials.

*EMPORIA, VA.—Bids are asked by the Town Council until 8 p. m., July 23, for one 50-HP. latest improved gasoline engine of the most approved make, one single-acting triplex power pump, with capacity of 750 gallons of water per minute, pump to work against a constant pressure of 130 lbs. to the square in. Pumps must be driven by direct connection with gasoline engine. J. R. Gruszard is Town Clk.

BEAUFORT, S. C.—The city has voted $43,000 of bonds to purchase water-works or construct a new system, for other improvements.

MACON, GA.—The Macon Water Co. contemplates expending $10,000 and $15,000 in laying mains, ranging in size from 6 to

*PENSACOLA, FLA.—Bids will be received by the Board of Bond Trustees until 12 m., July 30, for furnishing, delivering and erecting one air compressor and receiver and one compressor to be capable of compressing sufficient air to lift 2,000,000 gallons of water from 13 driven wells to the reservoir. Chalkley Hatton is Consulting Engr.

NEW ORLEANS, LA.—The Sewerage & Water Board opened bids on June 30 for furnishing the Algiers pumping station with high and low lift pumps and machinery accessories. The bidders were: D'Olier Co., $25,844; Joseph McWilliams, $33,289; Allis-Chalmers Co., $30,600; McIntosh & Co., $29,996; A. M. Lockett & Co., $27,[illegible] & Biggar, $32,451.

TOLEDO, OHIO.—The Board of Public Service on July 8 rejected all bids for the construction of the water-works pier, which were more than double the estimate of the City Engineer. The bids made for the intake pipes were taken under advisement and will be disposed of within a few days. The board will begin readvertising at once for new offers on the pier.

COLUMBUS, OHIO.—The City Council has passed an ordinance providing for the issue of $40,000 of bonds for laying water mains in streets as they are improved.

CINCINNATI, OHIO.—Bids are asked until noon, Aug. 7, by the Commissioners of Water-Works for the construction of a storehouse at the west end of the bridge approach to the intake pier for the river pumping station. Elmer G. Prior is Clk. Comrs.

EAST JORDAN, MICH.—The citizens on June 24 voted to issue $19,825 bonds for extending the water-works.

CHICAGO, ILL.—The Board of Public Works will soon ask for bids for the construction of the Roseland pumping station at 103d St. and Stewart Ave., to have a daily capacity of 100,000,000 gallons.

WILMETTE, ILL.—We are officially advised that bids were received on July 8 by the city for (a) centrifugal pumps; (b) induction motors at 110 R. P. M.; (c) at 115 R. P. M.; (d) 26,400 ft. of lead covered cable: John A. Roebling's Sons Co., Chicago, Ill., (d) $25,212; The American Well Works, (a) $48,000; Standard Underground Cable Co., (d) $24,618; Westinghouse Electric & Mfg. Co., Chicago, Ill., (b) $21,100; (c) $14,900; Crocker-Wheeler Co., Ampere, N. J., (b) $14,702; (c) $12,257; W. A. Jackson Co., Chicago, Ill., (b) $18,922, (c) $12,-276, (d) $25,146; Western Electric Co., Chicago, Ill., (b) $12,180, (c) $10,575; Camden Iron Works (R. D. Wood & Co.), (b) $36,-850, (c) $34,465.

ALEXANDRIA, MINN.—Bids are asked until July 17 by W. B. Mitson, Village Recdr., for furnishing the mechanical and electrical equipment and the building required in the reconstruction of the electric light and water plant and system. Estimated cost, $20,000. Edward P. Burch is Consulting Engr., 1210 Guaranty Bldg., Minneapolis, Minn.

LINDSTROM, MINN.—Bids are asked until July 20 by L. J. Andrews, Village Recdr., for erecting an 80-ft. steel tower for the support of a 50,000-gallon tank, and for placing the old tank upon the new tower and for the removal of the old wooden tower.

BELOIT, KAN.—The Council has passed an ordinance providing for an issue of bonds to improve, repair, rebuild and extend the water-works. C. R. Herrick is City Clk.

BELLEFOURCHE, S. DAK.—In connection with the excavation work of the South Side Canal, Bellefourche Project, the following contracts have been awarded For the construction of Section 2A, consisting of about 42,100 cu. yds. of excavation, to LEONARD SEITZ, Vale, S. Dak., at $8,052; for the construction of Section 2B, consisting of about 50,000 cu. yds. of excavation, to J. W. McNEEL, of North Platte, Neb., at $9,088.

*PIERRE, S. DAK.—The undersigned will receive bids for removing the 6-in. w.-i. casing from two artesian wells, about 1,350 ft. deep, and replacing it with 6in. c.-i. casing. The city will furnish cast-iron casing and couplings. For further particulars address John I. Newell, Chn. Gas & Water Comn.

KANSAS CITY, MO.—About $750,000 will be expended for improvements, including the construction of a new intake, new settling and storage basins and new pumping engines. Plans are now being prepared. William G. Goodwin is Acting Ch. Engr. W.-Wks. Dept.

DENISON, TEX.—The city has voted to purchase the plant of the Denison City Water Co. at $110,000.

FORT MORGAN, COLO.—The citizens on June 30 voted in favor of issuing $55,000 of bonds for the extension and enlargement of the light and water-works plants.

CHEHALIS, WASH.—The citizens on June 30 voted in favor of issuing $175,000 of bonds for the installation of a gravity water system.

HANFORD, WASH.—The Hanford Irrigation Co. has voted a $500,000 increase in its stock, half of which will be placed on sale at once and the proceeds used to increase the pumping plant and otherwise enlarge the operations of the company.

WILLIAMS, ARIZ.—The Grand Canyon Electric Light Co. has decided to apply to the City Council for a franchise to operate a water works system in connection with its electric light plant. The city has had under consideration the question of purchasing the electric light plant of the company, including the Caufman dam and site and the Kellis water system, for $75,000 and to expend $25,000 for improvements. V. H. Mellick, Williams, is Mgr.

SEWERAGE.

(denotes that this work is advertised in Engineering News.)*

RUTLAND, VT.—PASCAL RECCI, of Rutland, has been awarded the contract for construct[ing] two miles of pipe sewers here. Bids were opened on June 29. A. C. Grover is City Engr.

LOWELL, MASS.—The City Council has voted the sum of $15,200 for sewers to be constructed in the Wigginsville district.

MATTAPAN (Boston post-office), MASS.—Bids are asked until July 17 by the Board of Trustees of the Consumptives' Hospital for constructing a pipe sewer and drain at the hospital grounds, River St., Mattapan. Edward McSweeney is Chn. Bd., Boston, Mass.

BOSTON, MASS.—Bids were opened on June 29 by the Metropolitan Water and Sewerage Board for the extension of the high level sewer, South Metropolitan system, Brighton, The lowest bid was submitted by Glen & Broderick, 945 Old South Bldg., Boston, at the following prices: Earth excavation, 25; refill, in trench, 42-in. concrete sewer, $14; concrete masonry, Portland, in manholes, $4.75; earth excavation and rock excavation as found, per cu. yd., $4; in trench, 12-in. vitrified pipe sewer, $1.49; total, $8,914. Other bidders were: Rowe Contracting Co., Melrose, $20,170; Bruno & Petitti, 18 Tremont St., $14,784; Donovan & Phillips, 15 Beacon St., $14,181; Falvey & Kelly, 15 Intervale Park, Dorchester, $13,-707; Geo. M. Bryne Co., 7 Water St., $13,-254; Coughlan & Shiels Co., 104 Hanover St., $12,862; Mark H. Lynch, 106 School St., Roxbury, $12,725; McCarthy & Walsh, 454 Saratoga St., East Boston, $12,459; A. M. Cusack, 95 Milk St., $11,491; James Driscoll & Son, Brookline, Mass., $11,214; James H. Ferguson, 22 Parkman St., Dorchester, $10,-544; Charles J. Jacobs Co., 107 Terrace St., Roxbury, $9,766.

*LANCASTER, N. Y.—Bids are asked by the Board of Sewer Commissioners until 8 p. m., July 24, for the construction of a system of sewers, including sewage disposal plant. Fairchild & Gatchel, Lancaster, are Superv. Engrs.

YONKERS, N. Y.—Bids are asked until 8 p. m., Aug. 3, by the Board of Contract and Supply for constructing a sewer in a portion of Van Sice Ave. James D. McIntyre is Secy. Bd.

JAMESTOWN, N. Y.—JAMES P. CALAHANE was awarded the contract on July 6 by the Common Council for the construction of sewers here at $38,863.

NORTH TONAWANDA, N. Y.—The citizens on July 6 voted $35,000 for the extension of the sewer system.

TRENTON, N. J.—Bids are asked until 8 p. m., July 21, by the Common Council for the construction of sewers in certain streets. Harry B. Salter is City Clk.

JERSEY CITY, N. J.—Bids are asked until 2 p. m., July 20, by the Board of Street and Water Commissioners for constructing a sewer in Romaine Ave. George T. Bouton is Clk. Bd.

PATERSON, N. J.—The construction of a trunk sewer from Paterson to Newark Bay to remove the pollution from the Passaic River has been practically assured by an agreement of ten of the municipalities of the Passaic Valley district to join in a contract to build such a sewer without further delay or investigation. The municipalities voting to make the contract were Newark, Passaic, East Orange, Belleville, Kearny, Harrison, East Newark, Glen Ridge, Bloomfield and Rutherford. Estimated cost, $12,000,000.

RITTERSVILLE, PA.—DOYLE & CO. have secured the contract for erecting a sewage disposal plant at the State Homeopathic Hospital for the Insane near here, at about $30,000.

CAMBRIDGE SPRINGS, PA.—Bids are asked by A. H. Drake, Boro. Clk., until July 20 for the construction of about one mile of sanitary sewer extension.

BRADFORD, PA.—Separate bids are asked by Edward C. Charlton, City Clk., until July 20 for constructing street surface sewers in portions of Kennedy and Corydon Sts., and a sanitary sewer in Homestead Ave. A. F. Bannon, Jr., is City Engr.

*PHILADELPHIA, PA.—Plans and specifications are on file at the office of Engineering News, New York, for the construction of main sewers. Bids are asked until July 24.

GUYANDOTTE, W. VA.—The city has voted $6,000 of bonds for the construction of sewers.

*LOUISVILLE, KY.—The contract for the construction of Section A of the 25th St. relief sewer has been awarded by the Board of Sewer Commissioners to HINES BROS., of Canal Dover, Ohio, the lowest of seven bidders, at $30,036. List of bidders noted on July 2.

LEXINGTON, KY.—The Joint Improvement Committee of the General Council awarded the contract on July 7 for the construction of the southern main sewer to THOMAS AHERN & CO., at $9,275.

LOWELLVILLE, OHIO.—The State Board of Health has approved plans for the construction of a sewerage system for Lowellville.

CLEVELAND, OHIO.—Bids are asked by the Board of Public Service until noon, July 22, for the construction of sewers in various streets and avenues.

INDIANAPOLIS, IND.—The Board of Public Works on July 8 awarded the contract for the construction of the College Ave. sewer, seven miles long, to the MANSFIELD ENGINEERING CO. The company was the lowest bidder, offering to do the work for $27,000 less than the cost estimated by the city's engineers, which was $150,500.

FORT WAYNE, IND.—The Board of Public Works has rejected bids on the Forest Park-Lakeside sewer, as they exceeded the estimate. The only bids submitted were those of the Moellering Construction Co. and Derheimer & Co., at $6.40 and $6.65 per lin. ft., respectively. F. M. Randall is City Engr.

SHELBYVILLE, IND.—The City Council has let the contract for the drawing of plans and will soon ask for bids for the construction of a sewer system. Estimated cost, $150,000.

NORWAY, MICH.—JOHN STRIFFLER, of Marinette, Mich., has been awarded the contract for constructing the sewer system here, at $17,875.

CHEBOYGAN, MICH.—Bids are asked until July 21 by the city for the construction of a tile sewer. George N. Case is City Clk.

IRON RIVER, MICH.—The contract for the construction of the sewer system here has been awarded to P. McDONNELL, of Duluth, Minn., at $26,239. Seven bids were submitted, of which the highest was $31,530.

TAYLORVILLE, ILL.—The contract for constructing a sewer in Shawnee St. has been awarded to HAMILTON BROS. CONSTRUCTION CO., 4233 Wabash Ave., Chicago, at $13,953. Bids were opened on June 24. J. W. Deppert is City Engr.

BELLEVILLE, ILL.—The City Council has passed ordinances providing for sewering Glass Ave., and for paving Gold St. with vitrified brick. Estimated cost, $12,500. Frederick Deutschman, Jr., is City Engr.

MT. CARMEL, ILL.—Bids are asked by the Board of Local Improvements until July 16 for construction of sanitary sewer system No. 1, comprising five miles of sewers. Estimated cost, $18,000. Guy W. Courter is City Engr.

PIERRE, S. DAK.—We are officially advised that bids for the construction of sewers were received on July 9 by the City Council as follows: P. C. Construction Co., Pierre, $13,742; G. W. Haggart, Fargo, N. Dak., $13,629; C. A. Young, Pierre, $12,690; O. Englund, Pierre, $13,590; FERD SICKLE, De Grey, S. Dak., $11,567 (awarded contract); McMullen & Co., Pierre, $11,594.

ABERDEEN, S. DAK.—Bids are asked until 8 p. m., July 27, by F. W. Raymond, City Audr., for constructing sewer extensions, including 2,890 ft. of 20-in., 4,000 ft. of 18-in., 3,600 ft. of 15-in., and 366 ft. of 12-in., and 30 manholes and 900 ft. of 8-in. pipe.

DALHART, TEX.—The city has voted bonds for the construction of a sewer system.

PURCELL, OKLA.—The city has voted $62,000 of bonds for constructing a sewer system and for other improvements. M. S. Robertson, City Clk.

MIMICO, ONT.—It is proposed to install a sewerage system at the Mimico Industrial School. Estimated cost, $7,500.

BRAMPTON, ONT.—Bids are asked until July 20 by T. J. Blain, Town Clk., for constructing sewage liquefying tanks. Banks Rushford is Town Engr.

MONTREAL, QUE.—MICHAEL DINEEN has been awarded the contract for the first section of the Sherbrooke St. sewer, from Delorimier Ave. to St. Denis St., at $65,000, and A. BELLEHUMEUR for the Valois St. sewer at $5,180.

LUNENBURG, N. S.—The town will improve the water-works and sewerage systems. Estimated cost, $25,000.

GARBAGE DISPOSAL.

SCRANTON, PA.—Bids are asked by the Director of Public Works, until July 31, for the construction of an incinerating plant.

DETROIT, MICH.—Bids are asked until 10 a. m., July 18, by the Department of Public Works, for one 2-horse street flushing machine. J. J. Haarer is Comr.

STREETS AND ROADS.

(denotes that this work is advertised in Engineering News.)*

*LAWRENCE, MASS.—We are officially advised that the following bids were received on July 8 by A. D. Marble, City Engr., for paving Essex St., about 28,000 sq. yds., with wooden blocks on a concrete base: Richard Lamb, 136 Liberty St., New York, $118,291; Simpson Bros. Co., 166 Devonshire St., Boston, Mass., $95,837; Frank H. Corwin Co., 1026 Old South Bldg., Boston, $101,630. U. S. Wood Preserving Co., 29 Broadway, New York, $98,407; Lawrence Granite Co., Lawrence Mass., $95,615; Coleman Bros., 15 Court St., Boston, $109,304. The first three bids were apparently in accordance with the requirements of the specifications; the last three were not in accordance with the specifications and may have in some case been based on a 3-in. and not on a 4-in. block, as required. The last three also furnished their own specification for the treatment of the block which was that of the U. S. Wood Preserving Co.

NEW YORK, N. Y.—Bids are asked by the President of the Borough of Manhattan until 2 p. m., July 21, for widening the roadway and repaving with asphalt pavement on a concrete foundation the widened roadway of a porportion of Fifth Ave.; for regulating and repaving with asphalt pavement and granite block pavement on a concrete foundation the roadways of several streets; and for maintaining the asphalt pavements on various streets where the original contracts have been abandoned. John Cloughen is Acting Boro. Pres.

NEW YORK, N. Y.—Bids were received by the Park Board on July 9 as follows for furnishing and delivering 70,000 asphalt blocks on Riverside Drive, between 72d and 122d Sts., Boro. of Manhattan: Barber Asphalt Paving Co., 114 Liberty St., New York, $74.10 per M., or $5,187; Harlem Contracting Co., 1618 Lexington Ave., New York, $73.60 per M., or $5,152. Henry Smith is Pres. Bd.

NEW YORK, N. Y.—Bids are asked by the Park Board until 3 p. m., July 23, for furnishing all the labor and materials for repairing and surfacing with asphaltic earth the Bronx and Pelham Parkway, from the Williamsbridge Road to the Eastchester Road, in the Borough of the Bronx, City of New York. Henry Smith is Pres. Bd.

*AUBURN, N. Y.—The following bids were received on July 7 by the Common Council for paving: (a) Garden St., (b) William St., (d) constructing subways in Garden St., (e) in William St.: Warner-Quinlan Co., Syracuse, N. Y. (a) $13,606, (b) $11,520, (c) $4,-386, (d) $4,123; BRAYER BROS., Auburn, N. Y. (a) $13,338, (b) $11,237, (c) $4,123, (d) $3,677 (awarded contracts); Barber Asphalt Paving Co., 131 Broad St., Utica, N. Y. (a) $13,926, (b) $11,767; Guymore Gest, New York (c) $6,285, (d) $5,834; William P. Holahan, Auburn, N. Y. (c) $4,601, (d) $3,857; Jerry Corkery, Auburn, N. Y. (d) $5,079. Brayer Bros. will deduct 10% per sq. yd. if the guarantee for the paving is for eight years instead of ten. J. S. Hanlon is City Clk.

YONKERS, N. Y.—Bids are asked until 8 p. m., Aug. 3, by the Board of Contract and Supply for regulating, grading and otherwise improving certain streets. James D. McIntyre is Secy. Bd.

*NEWTON, N. J.—Bids are asked until 11 a. m., July 31, by the Board of Chosen Freeholders, for grading and macadamizing a section of public road in the Township of Frankford and Sandyston in Sussex County, about 3½ miles long.

*VERONA, N. J.—Bids are asked until 3 p. m., Aug. 10, by the Committee on Roads and Assessments of the Board of Chosen Freeholders of Essex County, Newark, N. J., for grading and paving with Telford pavement Fairview Ave., Borough of Verona and Township of Cedar Grove, extending from Bloomfield Ave. to Pompton Turnpike. Michael Barry is Dir. Bd.

WILDWOOD, N. J.—J. F. SHANLEY, Philadelphia, Pa., has been awarded the contract at about $30,000 for macadamizing here.

TOMS RIVER, N. J.—Bids are asked until noon, July 21, by James E. Otis, County Dir. of Roads, for constructing three miles of gravel road in Plumstead Township, and 15,140 ft. of gravel road in Lakewood Township. J. H. Cramer, Engr., Cedar Run, N. J.

PERTH AMBOY, N. J.—Bids are asked until 3 p. m., July 16, by James Knox Taylor, Superv. Arch., Washington D. C., for constructing lot walls and sidewalks at the U. S. post-office and custom-house, Perth Amboy.

WILKES-BARRE, PA.—SCHMIDT & DUNN, Wilkes-Barre, have been awarded the contract by the city at $53,000 for resurfacing the city streets with asphalt.

HARRISBURG, PA.—The Councils on July 6 awarded the contract to the STUCKER BROS. CONSTRUCTION CO. for paving State St., from Tenth to 13th Sts., with vitrified block, at $13,715. Bids were also submitted by the Barber Asphalt Paving Co. and Warner-Quinlan Co. for sheet asphalt, but owing to the steep grade of the street to be paved bricks were deemed more practical.

ALTOONA, PA.—The following bids were received on June 30 by the State Highway Department for the construction of (a) 8,030 ft. of road from the Stonycreek Township line to near Geistown, Richland Township, (b) 4,050 ft. in Stonycreek Township, (c) total of both sections of road: W. T. Pennock, Altoona, Pa. (a) $27,770, (b) $19,953, (c) $47,724; Nelson-Meredith Co., Chambersburg, Pa. (a) $26,508 and $26,104, (b) $12,880 and $12,667, (c) $38,744; E. A. Freshwater & Sons, Chester, W. Va. (a) $33,892, (b) $21,-953, (c) $55,846; Vipond Construction Co., Altoona (a) $25,622 and $25,114, (b) $13,325 and $13,003, (c) $38,117; John L. Elder, Ebensburg, Pa. (a) $28,197, (b) $19,229 and $19,047, (c) $46,895; Saupp & Drhew, Altoona, Pa. (a) $23,224, (b) $12,569, (c) $35,-891; J. E. Francis, Punxsutawney, Pa. (a) $27,210, (b) $13,725, (c) $40,935; George W. Clark, Johnstown, Pa. (a) $25,574, (b) $20,-852, (c) $46,426; R. A. Reighart, Johnstown (a) $24,824 and $24,524, (b) $19,386 and $19,-136, (c) $43,659.

MILL HALL, PA.—E. M. GOOD, of Lancaster, Pa., has been awarded the contract for the construction of a macadamized state road through this place at $7,768, and also the contract for the construction of the Lamar Township road, near here, at $12,427.

NEW CASTLE, PA.—NORMAN J. BOYER, of Butler, Pa., has been awarded a contract for the construction of several miles of improved state road in the vicinity of this city. The road will be paved with brick.

WASHINGTON, PA.—The W. E. HOWLEY CONSTRUCTION CO., of Pittsburg, Pa., has been awarded the contract for the construction of three miles of the Dry Run Road; N. C. HUNTER, of this city, has been awarded the contract for three miles of the Labrotory-Lone Pine Road; and the HALLAM CONSTRUCTION CO., of this city, has been awarded the contracts for the construction of the Washington-Meadowlands Road and the Houston-Westland Road, the total of the latter being about 3¼ miles. Each of the contracts was taken at about $38,000.

WASHINGTON, D. C.—Bids were received as follows on July 11 at the office of the Commissioners of the District of Columbia for paving and grading in the District: Sheet asphalt: Barber Asphalt Paving Co., Philadelphia, Pa., $1.60 per sq. yd. for sheet asphalt; $1.80 for vitrified block gutters; Cranford Paving Co., Washington, $1.48, $1.17; Brennan Construction Co., Washington, $1.56, $1.27. Bitulithic pavement: Atlantic Bitulithic Co., Richmond, Va., $2.50. Asphalt block: Washington Asphalt Block & Tile Co., Washington, D. C., 5-in. with gravel base, in city, $1.80; 4-in., city, $1.65; county, $1.80. Grading: E. G. Hummel, 300 Rhode Island Ave., Washington, Mills Ave., 40 cts.; Albemarle St., 45 cts.; Minnesota Ave., 40 cts.; 41st St., 45 cts.; Rittenhouse St., 45 cts.; Kearney St., 45 cts.; James Morton Duncan, Alexandria, Va., Mills Ave., 33 cts.; Albemarle St., 69 cts.; G. B. Mullin, Washington, Albemarle St., 37 cts.; 41st St., 27 cts.; Rittenhouse St., 27 cts.; Warren P. Brenizer Co., Washington, Albemarle St., 40 cts.; Minnesota Ave., 27.5 cts.; Studler & Raedy, Washington, Mills Ave., 42 cts.; Kearney St., 37 cts.; L. M. Johnston, Arlington, Va., Albemarle St., 53 cts.; Minnesota Ave., 43 cts; Kearney St., 49 cts.

*CUMBERLAND, MD.—Bids are asked by the Road Directors of Allegany County until noon, July 21, for improving the public road between Cumberland and Old Town, known as the Old Town road; between Frostburg, Maryland and Borden Shaft, known as the Lonaconing road; also between Westernport and Barton, known as the Legislative road. Clinton Uhl is Chn. Directors.

FARMVILLE, VA.—The Supervisors of Prince Edward have let the contract for building, about 2½ miles of macadam road from out of Farmville to the LUCK CONSTRUCTION CO., the lowest bidder, at about $10,235.

BLUEFIELD, W. VA.—Mercer County has awarded the contract to A. D. STONE & CO., Roanoke, Va., at $24,987 for grading and macadamizing 2.4 miles of county road.

GUYANDOTTE, W. VA.—The city has voted $19,000 of bonds for street paving.

COLUMBIA, S. C.—The ATLANTIC BITULITHIC CO., Mutual Bldg., Richmond, Va., has been awarded contract at about $154,000 to complete the paving of Main St. with bitulithic.

BRAIDENTOWN, FLA.—The CROCKETT PAVING CO., of Birmingham, Ala., has been awarded the contract for paving at the following bid: 6,500 sq. yds., with brick, including excavation and foundation, $1.97; 20,000 sq. yds. of macadam, 75 cts.; 14,000 sq. yds. 11-in. marl roads, 65 cts.

MONTGOMERY, ALA.—The city has awarded the contract to BYRON, SOUDERS & CO., at $90,159 for paving North Court St. A. R. Gilchrist is City Engr.

MEMPHIS, TENN.—Shelby County will construct nine miles af asphaltine roads at $435 per mile, on Summer Ave., North Second St., Poplar Ave. and other streets.

COLUMBUS, OHIO.—Bids are asked until noon, July 27, by the County Commissioners, John Scott, Clk., for grading, macadamizing, etc., Schrock Road in Sharon Township, 3.11 miles, and the Linwood Road in Sharon Township, 3.31 miles long.

TOLEDO, OHIO.—The ASPHALT BLOCK PAVING CO., Toledo, was awarded the contract on July 2 by the Board of Public Service for paving Scottwood Ave., with asphalt block at about $14,333.

*WADSWORTH, OHIO.—Bids are asked by the Village Council until noon, July 25, for the furnishing of the necessary labor and materials for the grading, draining, setting curbs and paving with paving bricks to the established grade of High St., from the north line of Maple Ave. to the south line of the Akron Road. Said bids shall be for all necessary materials and labor. Louis F. Allen is Village Clk.

HARTFORD CITY, IND.—The following bids were received on July 3 by the city for street paving: Hollman & Co., Rochester, Ind., Indiana block, $17,444; Logan brick, $17,368; Metropolitan, $17,718; J. P. Knight, of Greenfield, Ind., Indiana, $17,519; Logan, $17,777, Metropolitan, $17,847.

GREENCASTLE, IND.—Bids are asked by the Commissioners of Putnam County until Aug. 1, for the construction of 5,286.6 ft. of macadamized road in Jefferson Township East, and 10,833.9 ft. of macadamized road in Jefferson Township West. D. V. Moffett is County Audr.

GREENCASTLE, IND.—The contract for constructing 11,417 ft. of macadamized road in Millcreek Township has been awarded to WILLIAM H. STRINGER, of Fillmore, Ind., at $3,500. Bids were opened on June 27. D. V. Moffett is County Audr.

ANDERSON, IND.—Bids are asked by the Commissioners of Madison County until Aug. 1 for the construction of 23 separate gravel roads, aggregating nearly 50 miles in length.

TIPTON, IND.—Bids are asked by the Commissioners of Tipton County until Aug. 3 for the construction of five macadamized roads, 10,572, 5,272, 11,050, 10,572 and 5,272 ft. in length, respectively, in Madison Township; nine macadamized roads in Liberty Township, 2,955, 3,928, 11,678, 9,247, 5,040, 2,756, 3,490, 13,206 and 5,237 ft. in length, respectively, and two gravel roads in Jefferson Township, 2,876 and 1,218 ft. in length, respectively. J. F. Barlow is County Audr.

VINCENNES, IND.—Bids are asked by the Commissioners of Knox County until 2 p. m., Aug. 4, for the construction of 2,681 ft. of gravel road in Vincennes Township. John T. Scott is County Audr.

GREENSBURG, IND.—Bids are asked by the Commissioners of Decatur County until noon, July 27, for the construction of a free gravel road on the line between Decatur and Rush Counties, 22,520 ft. in length. Frank E. Ryan is County Audr.

SHELBYVILLE, IND.—Bids are asked by H. J. Clark, City Clk., until 7.30 p. m., July 28, for the construction of several miles of cement sidewalks.

ANDERSON, IND.—Bids are asked by the Commissioners of Madison County until 2 p. m., Aug. 1, for the construction of 11,208 ft. of gravel road in Adams Township, and 5,280 ft. in Monroe Township. William T. Richardson, County Audr.

MUNCIE, IND.—Bids are asked by the Commissioners of Delaware County until Aug. 5 for the construction of two gravel roads in Liberty Township. Joseph E. Davis is County Audr.

BLOOMINGTON, IND.—Bids are asked by the Commissioners of Monroe County until Aug. 5 for the construction of seven gravel roads. Samuel M. Kerr is County Audr.

AURORA, ILL.—We are officially advised that bids were opened on July 7 by the city for the improvement of (a) Center Ave. and Grant Place, (b) Clark St., (c) South River St., (d) Fifth St.: McCarthy Improvement Co., (a) $18,340, (b) $2,874, (c) $20,-

798, (d) $26,019; Standard Construction Co., (a) $18,668, (b) $2,904, (c) $21,890, (d) $26,316; J. E. Salisbury & Co., (a) $18,663, (b) $3,062, (c) $21,290, (d) $26,878; A. W. Eisenmeyer, (a) $20,156, (b) $3,206, (c) $22,-386, (d) $28,412. Marquette Construction Co., (a) $19,284, (b) $3,116, (c) $22,025, (d) $27,-363; J. R. Heineman, (a) $19,784, (b) $3,143, (c) $21,794, (d) $27,857; Forrestal & Feyer, (a) $20,055, (b) $3,120, (c) $22,902, (d) $28,-219.

C. J. Jones submitted the lowest bid for improving the Street Railway Company's share of South River St., 3,270 yds. of brick.

SPRINGFIELD, ILL.—The contract for paving Washington St., 18,500 sq. yds. brick and 11,150 lin. ft. of concrete curb and gutter, has been awarded to JOHN STRIFFLER, of Springfield. Estimated cost, $41,798.

The contract for paving Cook St., 15,100 sq. yds. of brick pavement and 6,500 lin. ft. of sandstone curb, has been awarded to RICHARD EGAN, of Springfield, at about $27,131.

FOND DU LAC, WIS.—Bids are asked until 3 p. m., Aug. 1, by the Board of Public Works for improving a portion of Forest Ave.

OTTUMWA, IOWA.—Bids are asked until July 20 by the city for about 9,000 sq. yds. of brick paving and 3,300 lin. ft. of Portland cement curb. J. T. Brady is City Engr.

ST. PAUL, MINN.—The Board of Public Works on July 2 awarded the contract to the GENERAL CONTRACTING CO. for macadamizing University Ave., from Raymond Ave. to the city limits, at $23,300, of which the city railway will be required to pay $7,000, between the car tracks.

GRAND FORKS, N. Dak.—Bids are asked until 5 p. m., July 23, by the City Auditor for street paving, 50,000 sq. yds.

PIERRE, S. DAK.—We are officially advised that bids have been received as follows for grading here: I. FANELUST & SONS, Sioux Falls, S. Dak., $34,550 (awarded contract); Ferd Sickel, De Grey, S. Dak., $42,-475.

LITTLE ROCK, ARK.—The ARKANSAS BRICK & PAVING CO., of Little Rock, has been awarded the contract for furnishing the material and paving South Main St., from Eighth to Twenty-fourth Sts., with vitrified brick, at about $85,000. E. A. Kingsley is Supt. Pub. Wks.

HUGO, OKLA.—The ARDMORE FOUNDRY, MACHINE & BRIDGE CO., Ardmore, Okla., has been awarded the contract at $40,000 for constructing several miles of concrete walks, crossings, culverts and a sewer system here. H. Farrar, Hugo, is Engr.-in-Charge.

SEATTLE, WASH.—The City Council has passed ordinances ordering the following street improvements: 25th Ave. North and other streets, concrete walks, $33,100; North 46th St. and other streets, grading, $21,050; 14th Ave. N. E. and other streets, asphalt paving, $34,250; 23d Ave. and other streets, asphalt paving, $125,000; 27th Ave. South and other streets, same, $61,000; West Galer St. and other streets, same, $81,400. R. H. Thomson is City Engr.

SEATTLE, WASH.—Bids were received as follows on July 3 by the Board of Public Works for improving (a) 16th Ave. North and other streets, (b) Roy St. and other streets: P. J. McHugh, Seattle (a) $245,863; Rich & Harris Construction Co., Bailey Bldg., Seattle (a) $247,339; Independent Asphalt Paving Co., Pioneer Bldg., Seattle (a) $250,782, (b) $197,497 (granite curb), $197,-343 (armored concrete curb); Barber Asphalt Paving Co., Mutual Life Bldg., Seattle (a) $279,928, (b) $187,430 and $187,173; F. McLellan, Burke Bldg., Seattle (b) $178,417 and $178,288.

MANUFACTURING PLANTS.

SOUTH BOSTON (Boston post-office), MASS.—We are officially advised that plans are being prepared for an industrial plant to be erected in South Boston on the water front; it will contain 3,000,000 sq. ft. of floor space, to be rented for manufacturing purposes. There will be about 20 buildings, eight stories high, fireproof, of reinforced concrete; wharf will have an area of over a million sq. ft. The buildings will be equipped with wire glass set in metal window frames, toilet rooms on every floor, automatic sprinklers and fire fighting appliance. The plant will be served by 50 high-speed passenger and freight elevators, and electric power and light, steam heat, gas and compressed air will be furnished from a central plant on premises. Producer gas engines probably will be installed to the ultimate amount of 10,000 HP. The power plant will be equipped with coal-handling apparatus and ample storage. There will be a car ferry or lighterage system. The entire cost will be over $10,000,000, the construction to extend over five or more years, but the first section will be completed and ready for occupancy early in the summer of 1909. Financial arrangements have been made and active work will begin early in the fall. H. L. Gilman, 26 Linden Pl., Brookline, Mass., is Consult. Engr.

HARTFORD, CONN.—Permission to erect a 4-story factory building, 83 ft. 4½ ins. × 39 ft. 6 ins., on Hoadley Pl., has been issued to the Beseman & Bostwick Co. by F. J. Bliss, Bldg. Inspector. Work will be started at once. The building will be of brick with brownstone trimmings.

NEW BRITAIN, CONN.—The Stanley Rule & Level Co. has had plans prepared for the construction of a 3-story factory building, 60 × 90 ft., at Elm and Church Sts. The building will be of brick and heavy mill construction.

BRISTOL, CONN.—The C. G. Garrigus Machine Co., has awarded to the TORRINGTON BUILDING CO., 264 Water St., Torrington, Conn., the contract for an addition to its plant. The new structure will be a 3-story brick building, 37 × 75 ft., with an ell, 10 × 35 ft.

DEPEW, N. Y.—The New York Central & Hudson River R. R. Co. will build a brick addition, 75 × 161 ft. to the boiler shop of its locomotive repair plant at this town, to cost $25,000. B. I. CROOKER, 4 Builders' Exchange, Buffalo, has the contract for the work.

EAST SYRACUSE, N. Y.—The New York Central & Hudson River R. R. Co. has let general contract to MARCELLUS & BALLARD, of Oneida, N. Y., for constructing a 20-stall round-house, at East Syracuse.

WEST ALBANY, N. Y.—The New York Central & Hudson River R. R. Co. has let general contract to LYNN B. MILLIKEN, 1675 Bailey Ave., Buffalo, N. Y., for a 1-story steel-frame erecting shop, 442 × 100 ft., at West Albany. Cost, $200,000. George W. Kittredge is Ch. Engr., Grand Central Station, New York.

OSSINING, N. Y.—Contract has been let by L. C. Holden, Arch., 1133 Broadway, New York, to H. WALES LINES CO., 134 State St., Meriden, Conn., for constructing a reinforcing factory, extension to foundry and boiler house, at Ossining, for Rand, McNally & Co., New York.

LONG ISLAND CITY, N. Y.—We are officially advised that L. K. COMSTOCK & CO., 50 Church St., New York, has contract for heating, light and power equipment for a 7-story factory at Long Island City belonging to J. F. Blanchard, manufacturer of fireproof doors, Flatiron Bldg., New York.

PHILADELPHIA, PA.—A permit was issued by the Bureau of Building Inspection to EDWARD FAY & SON, contractors, 2666 Richmond St., to build a 1-story powerhouse, 21 × 93 ft., an office and warehouse, 96 × 345 ft., a car shelter shed, 45 × 88.6 ft., a paint shop, 36 × 88.6 ft., and a blacksmith shop, 15 × 25 ft., on Lehigh Ave., east of Broad St., for the Philadelphia & Reading Railway Co. The contract price is $47,000. H. D. Taylor, Supt. Motive Power, Reading, Pa.

PUNXSUTAWNEY, PA.—BOWERS BROS., proprietors of the East End Planing Mill, have secured the contract for erecting the buildings for the Eldred Window Glass Co. There will be five buildings constructed, and the contract stipulated that they must be ready for occupancy in 90 days, or by Oct. 1.

READING, PA.—The PENNSYLVANIA IRON & STEEL CO., Philadelphia, has secured a contract for the structural iron for Deppen Brewing Co.'s brewery here. The contract price is $30,000.

UNIONTOWN, PA.—Surveyors are at work locating a plant of 30 coke ovens which will be constructed on Cheat River, in Springhill Township. Wade Echard, Uniontown, is Supt.

SHARON, PA.—The Petroleum Iron Works Co., of this city, has awarded a contract to the R. D. WOOD CO., 400 Chestnut St., Philadelphia, Pa., for building and installing a 200-ton sectional flanging press at the plant at Masury, near this city. The press will operate under 1,500 lbs. hydraulic pressure, will have a 60-in. gap, an 8¼ × 6-ft. table, and will be equipped with two vertical rams, each of 100 tons capacity and 30-in. stroke. These rams will be so constructed that they can be operated independently or together. The press will also have one horizontal ram of 50 tons capacity with 24-in. stroke and a supplemental ram with 24-in. stroke.

NEW CASTLE, DEL.—The Deemer Steel Casting Co., it is stated, has been incorporated with a capital of $150,000, for the purpose of erecting a plant here. Selden S. Deemer is Pres.

HARRISVILLE, W. VA.—The Imperial Oil & Gas Products Co., recently incorporated, will establish a plant to manufacture gasoline and high-grade carbon black. The company will erect a building with structural iron frame and sheet iron roof, etc. Cost of building, $10,000. Joseph Harman, Jr., Harrisville, is Mgr. William Little, Bradford, Pa., is Engr.-in-Charge.

FAYETTEVILLE, N. C.—J. P. Ewing, of Dillon, S. C., contemplates enlarging his building to manufacture flour, meal, grits and feed. He will install woodworking machinery later. He will use water-power, now partially developed.

COLUMBUS, GA.—C. F. Sharpe, of Nashville, Tenn., and associates have purchased 672 acres of land on the Chattahoochee River in Alabama, near Columbus, Ga., and contemplate the erection of a cotton mill.

GRIFFIN, GA.—It is stated that the construction will be started soon on the plant which was planned some time ago by the Cherokee Mills of Griffin. The company was formed to establish a plant of 10,000 spindles and 350 looms for the manufacture of cotton towels and blankets. The capital stock is $200,000, and J. J. Mangham is Pres.

MONTGOMERY, ALA.—The Germo-Fert Mfg. Co., 225 Fifth Ave., New York, will build in Montgomery a plant in which about $500,000 will be invested. The preliminary details have been arranged, the site has been selected, the work will begin soon. A. B. Chisholm is Pres. of the Germo-Fert Mfg. Co.

HOLLINS, ALA.—The Kaul Lumber Co. probably will rebuild its plant, recently destroyed at a loss of about $500,000.

ST. STEPHENS, ALA.—The Mobile Portland Cement & Coal Co. will be organized, with a capital stock of $6,000,000 and an authorized bond issue of $3,000,000, to build plant with daily capacity of 3,000 bbls. Portland cement and to develop 20,000 acres of coal land. The company has 1,800 acres of land for cement development and site of plant, and intends using its output of slack and screen coal (about 300 tons daily) at the cement plant, and shipping the better grade to Mobile for exporting. It will build four river tow-boats and 40 barges for freighting coal from mines to Mobile. According to the "Manufacturers' Record" the company will have the following directors: William Watson Thompson, E. L. Russell, Pat J. Lyons, R. V. Taylor, L. Hammel, A. S. Lyons, James Keoughan and others of Mobile, Ala.; John R. Markley, of Chicago, Ill., and William J. Oliver, of Knoxville, Tenn. Immediately after election of officers plans will be formulated for awarding contracts to build and equip proposed plant. William Watson Thompson, Mobile, Ala., is Mgr.

GRENADA, ALA.—The Illinois Central R. R. Co. has purchased 40 acres of land near the town of Grenada, and on which it will establish a duplicating factory. The intention is to have this factory furnish all the bridge timbers to be used on the Illinois Central between Carbondale, Ill., and its Southern terminus. W. O. Moody is Mechanical Engr.

DAYTONA, FLA.—The YORK MFG. CO., York, Pa., has secured contract to install a 20-ton ice plant for Adam Schantz.

BURRWOOD, LA.—We are officially advised that bids were received on July 8 by Col. R. H. Ruffner, Corps Engrs., U. S. A., Custom House, New Orleans, La., for constructing a reinforced-concrete plant at Burrwood, Southwest Pass, Mississippi River. The bid of Peter Eskald of Biloxi, Miss., at $49,158, has been recommended for acceptance.

MEMPHIS, TENN.—The American Snuff Co. has purchased a tract of land in South Memphis. The company will erect a snuff factory and a tin can factory, to cost about $100,000. The company will remodel and enlarge an old box factory now on the land and will manufacture boxes in which to ship snuff.

DAYTON, OHIO.—Bids are asked by the Dayton Lumber Mfg. Co. until about July 20 for the proposed factory building.

CLEVELAND, OHIO.—Lehman & Schmitt, Archs., Garfield Bldg., have completed plans for a 4-story light manufacturing and store building for the Atlantic Refining Co., S. D. Wise, Mgr. The structure will cost $30,000.

COLUMBUS, OHIO.—The Buckeye Steel Castings Co. has let the contract for the proposed machine shop at its Parsons Ave. plant to the MT. VERNON BRIDGE CO., of Columbus. The building will be about 300 × 60 ft., of steel construction. Cost, $50,000.

ANDERSON, IND.—The Indiana Bridge Co., of Muncie, Ind., has completed plans for a brick factory building at Anderson, for the Frazier Stove Co., Indianapolis. Cost, $25,000.

STINESVILLE, IND.—It is stated that the U. S. Steel Corporation has secured land at Stinesville and will erect $1,500,000 worth of improvements at once, including stone crushing and refining mills, machine shops and an electric light plant.

WHITE PIGEON, MICH.—HENRY VANDERHORST, of Kalamazoo, Mich., has been awarded the contract for the construction of mills for the Oscar Felt & Paper Co., at White Pigeon. The main building will be 72 × 580 ft. and two stories high. Daniel J. Albertson, Kalamazoo, is Arch.

CHICAGO, ILL.—Three buildings that will cost about $600,000 are to be added to the plant of the Western Electric Co., at Hawthorne, West 22d Sts. and South 48th Ave. E. M. Barton is Pres.

The Corn Products Refining Co., 26 Broadway, New York, N. Y., will erect a glucose factory near Chicago. The plant will cost about $2,000,000. E. T. Bedford is Pres.

HEGEWISCH (Chicago post-office), ILL.—The Western Steel Car & Foundry Co., Old Colony Bldg., Chicago, is taking estimates on an addition to its manufacturing plant. Cost, $200,000.

LINCOLN, NEB.—George A. Berlinghof, Burr Block, is preparing plans for a 2-story factory building for the Rush Carter Mfg. Co. The building will cost $150,000.

HOUSTON, TEX.—The National Wire & Iron Fence Works, of Houston, Tex., will increase its capital from $40,000 to $100,000, and, as soon as a suitable location can be found, will erect a rolling mill for the purpose of reducing into billets scrap iron and steel rails, also manufacture railroad spikes, nails and merchantable iron. George L. Glass is interested.

DENVER, COLO.—Plans have been completed by Fallis & Stein, Archs., Colorado Bldg., for a 3-story factory and warehouse building for the Humphry-Jones Paint Co. $15,000.

SEATTLE, WASH.—It is stated that Armour & Co., of Chicago, Ill., will erect an 8-story plant here to cost $250,000 at the corner of Third Ave. and Jackson St. Thos. Kleinogel is Local Mgr. Work will be started within 30 days.

TACOMA, WASH.—The Tacoma Leather Co., incorporated with a capital of $40,000, by Joseph Sladek, A. F. Hoska and H. J. M. Munro, will erect a factory costing $25,000 at East 23d and Puyallup Sts. Mr. Sladek is Pres.

SPIRIT LAKE, IDAHO.—Work has begun on shops for the Idaho & Washington Northern R. R. Co., at Spirit Lake, Idaho, which are to be built and equipped by WESTINGHOUSE, CHURCH, KERR & Co., 10 Bridge St., New York, at a cost of $300,000, in addition to $100,000 for grading the site, etc. The construction is in charge of R. L. Taggart, of New York. The machinery will be driven by electricity.

ST. LAMBERT, QUE.—The L. E. Waterman Co., 136 St. James St., Montreal, Que., will erect a factory at St. Lambert, Que., to cost about $50,000, for the manufacture of fountain pens.

HAMILTON, ONT.—The Hamilton Tube Co., recently incorporated with a capital of $50,000, has acquired 5½ acres of land on Sherman Ave., where it will erect a plant and manufacture steel tubes.

KENORA, ONT.—Andrew Anderson and associates, of Winnipeg, Man., are considering the establishment of pulp and paper plant at Kenora, Ont., to cost about $3,800,000. They propose to acquire the water power and property of the Keewatin Power Co. About $1,000,000 will be spent the first year.

MOOSE JAW, SASK.—M. F. Bean, Pres. of the New Prague Milling Co., New Prague, Minn., has purchased the elevator and warehouse of the McL... Co. here. The capacity of the ... increased from 250 to 1,000 bbl... elevator from 65,000 to 150,000 b...

MISCELLANEOUS CONTR... FS.

(* *denotes that this work is ad... in Engineering News.*)

U. S. RECLAMATION SERVICE ... news relative to canal projects, etc., wi... found under Water Supply—Irrigation.

DITCH.—Redwood Falls, Minn.—... are asked until July 18, by L. P. Lars... County Audr., for constructing the tile ... for ditch No. 6.

DITCH.—Morocco, Ind.—Contract ... redging the Lawler Ditch, Newton Co... has been awarded to E. D. BARR, of ... ville, Mich., at about $18,000.

DREDGING.—Boston, Mass.—Bid... be received by the Board of Harbor ... Land Commissioners until 2 p. m., Jul... for dredging in Ipswich River.

DITCH.—Newcastle, Ind.—Bids ... asked by Nathan Nicholson, Drainage ... Henry County, until July 28, for ... tion of the John Adams Ditch.

DITCH.—Marshalltown, Iowa.—B... are asked by Erastus Cornell, Audr. ... shall County, until noon, Aug. 5, for co... tion of Marshall Drainage Ditch No. 3.

WATER HOSE.—New York, N. ... Bids are asked by the Department of Pa... until 3 p. m., July 23, for furnishing and ... iver-ing 10,000 ft. of water hose.

DITCH.—Champaign, Ill.—The T... OTHY FOOHEY CO., Fort Wayne, Ind., ... contract for dredging a ditch in Cha... paign County. Estimated cost, $26,000.

DREDGING.—Manitowoc, Wis.—B... are asked by Maj. W. V. Judson, Corps Engrs., U. S. A., Milwaukee, Wis., until ... m., July 16, for dredging at Manitowoc Harbor.

GRANDSTAND.—Louisville, Ky.—GUSTAV LORCH, of Louisville, has contract for building a grandstand of concrete and iron for the State Board of Agriculture, at $15,-600.

*BREAKWATER.—Ft. Morgan, Ala.—Bids are asked by Capt. L. F. Garrard, Jr., Const. Q. M., Ft. Morgan, until 1.30 p. m., Aug. 6, for constructing a breakwater and extending wharf at Fort Morgan.

DITCH.—Chillicothe, Mo.—Contract was let at public outcry on July 7 by Thomas Hurst, County Surveyor, for construction of drainage ditch in District No. 10, to JOHN KREIG, of Chillicothe, at $3,446.

AUTOMOBILES.—New York, N. Y.—Bids are asked by the Department of Docks and Ferries until noon, July 21, for furnishing all the labor and materials required for furnishing and delivering two automobiles.

LEVEE.—East St. Louis, Ill.—W. J. Crocken, City Engr., announces that plans are now being prepared for a concrete wall levee along bank of Cahokia Creek. Ordinance will not be ready for 60 or 90 days.

*LEVEE.—Vicksburg, Miss.—Bids are asked until noon, July 22, postponement from July 8, by Capt. Clarke S. Smith, Corps Engrs., U. S. A., Vicksburg, for about 511,-000 cu. yds. of levee work in the Third District.

RECREATION PIER.—Long Branch, N. J.—The Beach and Park Commission has awarded contract to WILBER CARLEY, of Long Branch, for constructing a recreation and fishing pier at foot of Broadway, at $4,320.

SPRAYING OUTFITS.—New York, N. Y.—Bids are asked by the Department of Parks until 3 p. m., July 23, for furnishing and delivering two 3-HP. mounted spraying outfits for the Department of Parks, Boro. of Bronx.

COAL BUNKERS.—Yonkers, N. Y.—Bids are asked by James D. McIntyre, Secy. Bd. Contract and Supply, until 8 p. m., July 20, for rebuilding and extending the coal bunkers at the new service station, Tuckahoe Road.

DRAFTING MATERIALS.—Washington, D. C.—Bids will be received at the office of James Knox Taylor, Superv. Arch., Treasury Dept., Washington, D. C., until 3 p. m., July 17, for furnishing and delivering drafting materials required.

DITCH.—Forest City, Iowa.—Bids will be received until July 21 by the Board of Supervisors at the office of L. J. Nelson, County Audr., for 138,450 lin. ft. open ditches, 4,884 lin. ft. 15-in., 19,380 lin. ft. 12-in., 12,336 lin. ft. 10-in. and 2,117 lin. ft. 8-in. pile drains.

RIVER IMPROVEMENTS.—Nebraska City, Neb.—Plans are being prepared by A. M. Munn, Engr., Nebraska City, for improving channel of Little Nemaha River. Excessive rains have delayed the field work. Engineer's report probably will be ready about Sept. 1.

*DREDGING.—Trenton, N. J.—Bids are asked by Harry Schneider, Comr. Inland Waterways, Trenton, until noon, Aug. 11, for dredging a section of the proposed inland waterway from Cape May to Bay Head, N. J., near the latter place. Harry J. Sherman, Engr.

FIRE BOAT.—Seattle, Wash.—The Board of Public Works, Seattle, will receive bids for the construction of a steel hull, twin-screw fire boat until 10 a. m., July 18. McAllister & Bennett, Consult Engrs. and Naval Archs., 22 Haller Bldg., Seattle. C. B. Bagley, Secy. Bd.

DREDGE.—Long Beach, Cal.—The CRAIG SHIPBUILDING CO., of Long Beach, has been given the contract for construction of a steel dredge, 110 ft. long, 35 ft. wide and 7½ ft. deep, for the Western Dredge & Marine Construction Co., composed of Long Beach and Redlands capitalists, which has a $2,-000,000 contract with the Los Angeles Dock & Terminal Co. to complete the harbor.

DREDGING.—Ottawa, Ont.—Bids are asked by the Department of Public Works, Ottawa, until 4 p. m., July 17, for dredging required in the following places in the Province of Ontario: Bowmanville, Green Shoals, Jackfish Bay, Leith, Newcastle, Rainy River, Spanish River.

PIER ... Baltimore, Md.—The Baltimore & Ohio R... Co. has awarded contract to the McLEAN CONTRACTING CO., Maryland Trust ... Baltimore, to rebuild the section of ... 8, Locust Point, which collapsed last ye... It will be 500 ft. long and 160 ft. wide a... will cost about $350,000.

DITCH ... Glenwood, Minn.—Bids were received ... July 7 by the County Auditor for digging ... constructing Judicial Ditch No. 1, Pope ... Stearns Counties. Contract has been a... ded to AMBROSE G. WAHL, St. Cloud. ... nn., at 6.88 cts per cu. yd. Morgan & ... lson, Engrs., St. Cloud, Minn.

*PIER ...—Boston, Mass.—Nine bids were received on July 6 by the Charles River Basin ... mmission, 367 Boylston St., for furnishing and installing piping at the lock in the ... harles River dam. Hiram A. Miller, Ch. E. ... The Merrill Co., 19 Pearl St., Boston ... as the lowest bidder, at $2,663.

*DREDGING.—Boston, Mass.—Bids are asked ... the Board of Harbor and Land Commissioners until 2 p. m., July 24, for dredging a channel at the entrance to Cuttyhunk Harbor, in the town of Gosnold. Estimated quantity, 18,000 cu. yds., scow measurement. Frank W. Hodgdon, Ch. Engr.

*DIKE.—Harrisburg, Pa.—Bids are asked by the Water Supply Commission of Pennsylvania until 1 p. m., July 28, for the work of constructing a dike and protecting the bank of the Delaware River for a distance of approximately 2,200 feet, at the borough of Matamoras, Pike County, Pa. Thomas J. Lynch, Secy.

DITCH.—Frankfort, Ind.—Bids are asked by the Drainage Commissioners of Clinton County until 2 p. m., July 25, for reletting contract for the Colfax Ditch No. 706. Wm. A. Robinson, Drainage Comr.

Bids are asked by Drainage Commissioner until 2 p. m., July 18, for construction of the Silas Williams Ditch, No. 715.

DREDGING.—Norfolk, Va.—Bids were received as follows on July 2 by Maj. Jos. E. Kuhn, Corps Engrs., U. S. A., for dredging in Norfolk Harbor off Hospital Point: Coastwise Dredging Co., 11¼ cts. per cu. yd.; Norfolk dredging Co., 10 7-10 cts., and John T. Bolton, 11 cts. Contract calls for dredging about 60,000 cu. yds. of mud and sand.

DITCH.—Council Bluffs, Iowa.—Bids are asked by the joint drainage boards of Harrison and Pottawattamie Counties until 2 p. m., July 20, for construction of the Boyer Cut-off No. 3. Bids for this work were asked until June 19, but none of the contractors enclosed the certified check required and all were rejected. Noted on June 4.

*DAM GATES.—Wheeling, W. Va.—Bids were received as follows on July 9 by Capt. F. W. Altstaetter, Corps Engrs., U. S. A., for constructing and erecting steel gates for locks at Dams Nos. 18 and 13, Ohio River: Lawrence D. Weaning, Cleveland, $35,215 each; Penn Bridge Co., Beaver Falls, Pa., $39,605 each; Pennsylvania Contracting Co., Pittsburg, $31,346 each. Itemized bids will be given next week under Contract Prices.

DRAINAGE DITCH.—Sioux Falls, S. Dak.—Bids were received on July 8 by C. E. Hill, Audr. Minnehaha County, for construction of Drainage Ditch No. 1. There will be about 100,000 cu. yds. of earth excavation and 600 cu. yds. of concrete masonry. Samuel H. Lea, State Engr., Pierre, S. Dak., prepared the specifications. Contract was awarded to FOLEY & GLEASON, Georgetown, Minn., at $20,850.

DREDGING.—Grand Marais, Mich.—Bids were received as follows on July 9 by Maj. Graham D. Fitch, Corps Engrs., U. S. A., Duluth, Minn., for dredging about 80,000 cu. yds. at Grand Marais: Duluth Marine Contracting Co., Duluth, Minn., 25 cts. per cu. yd.; Great Lakes Dredge & Dock Co., Duluth, 22.5 cts.; Zenith Dredge Co., Duluth, 23 cts.; LAKE ERIE DREDGING CO., Saulte Ste Marie, Mich., 18.75 cts. (awarded contract).

*SUBMERGED OUTLETS.—Boston, Mass.—Bids were received as follows on July 7 by the Charles River Basin Commission, 367 Boylston St., Boston, for constructing five timber submerged outlets for the Boston Marginal Conduit: Hiram W. Phillips, 734 Washington St., Quincy, Mass., $42,500; William L. Miller, 19 Milk St., Boston, $58,874; Coleman Bros., 15 Court Square, Boston, $59,050; W. H. Ellis, 17 Milk St., Boston, $63,456.

COAL PLANT.—Pittsburg, Pa.—Contracts for machinery and equipment for the plant of the Pittsburg-Buffalo Coal Co., at Mariana, Washington County, Pa., have been awarded to the WESTINGHOUSE ELECTRIC & MFG. CO. and other local concerns. Delivery will be started by Aug. 1. It is the intention of the Coal Company to build a new mining town with a population of about 15,000. The work involves expenditures of about $3,000,000.

*CHANNEL EXCAVATION.—Chicago, Ill.—Bids were received as follows on July 8 by L. J. Bryan, Clk. Sanitary District of Chicago, American Trust Bldg., Chicago, for excavating a channel designated as Section 6 of the North Shore channel and for performing certain collateral bridge work: John T. Fanning & Co., Chicago, $21,570; James O. Heyworth, Chicago, $22,910; John W. Page, Chicago, $24,680; W. J. Newman, Chicago, $25,360; J. J. McCaughry, Chicago, $31,365.

*DREDGING.—Duluth, Minn.—Bids were received as follows by Maj. Graham D. Fitch, Corps Engrs., U. S. A., Duluth, on June 30, for dredging in Duluth-Superior Harbor: Northern Dredge & Dock Co., Duluth, Minn., 11⅜ cts. per cu. yd. measured in place or in scows; the Fitz Simons & Connell Co., Chicago, Ill., 12¼ cts.; Duluth-Superior Dredging Co., Duluth, 10¾ cts.; Great Lakes Dredge & Dock Co., Chicago, 10¼ cts. (recommended for acceptance); Zenith Dredge Co., Duluth, 11½ cts. Amount proposed to be expended on this work, about $180,000.

CONCRETE WALL.—Portsmouth, Ohio.—Bids were received as follows on June 23 by the Board of Public Service for furnishing material and constructing flood defense in District No. 1. Contract was awarded to KELLEY BROS., of Portsmouth, at $25,548 for reinforced-concrete work. Other bids on concrete wall: John B. McLane & Co., Newport, Ky., $31,392; J. A. Grimes Eng. Co., Portsmouth, $26,985; Phils. Wickerham, Portsmouth, $45,113; Curtis & Shumway, Portsmouth, $30,023; E. G. Naye Bros. Co., Portsmouth, $32,940; W. H. Ringwald & Sons, Chillicothe, Ohio, $37,212; Kaps Bros., Portsmouth, $26,864, and S. Monroe & Son, Portsmouth, $28,277.

GUN CARRIAGES.—Washington, D. C.—Bids were received as follows on July 6 at the Army Ordnance Office for furnishing two 12-in. disappearing gun carriages, L. F., Model 1901: Midvale Steel Co., Philadelphia, Pa.—$46,119 each; first carriage in ten months and second in eleven months. Alliance Machine Co., Alliance, Ohio—for 1900 carriage, $36,455; for 1895 carriage, $36,000; first carriage in eleven months and second in twelve months. Morgan Engineering Co., Alliance, Ohio—$48,000; first carriage in 15 months and second in 18 months. Bethlehem Steel Co., South Bethlehem, Pa.—$46,000; first carriage in eleven months and second in 13 months.

PIPE LINE, ETC.—Bayonne, N. J.—The Tidewater Pipe Line Co., of Pennsylvania, and the Tidewater Oil Co., of Bayonne, N. J., branches of the Standard Oil Co., have completed plans for a western extension to cost about $5,000,000. It is planned to build from the headquarters of the company at Bradford, Pa., to the Illinois oil field, by way of certain of the oil-producing sections of Ohio. The line now extends from Bradford to Bayonne, N. J., and has a capacity of 10,000 bbls. daily. The line will be 550 miles long and will be of 6-in. main pipe, with smaller branches to producing territory. Of the $5,000,000 cost a portion will be used for the extension of the refining facilities at Bayonne.

*CEMENT.—Columbus, Ohio.—Bids were received by Chas. E. Perkins, Ch. Engr., State Board of Public Works, on June 23 for the delivery of Portland hydraulic cement, f. o. b. at the following railway stations: 2,160 bbls. delivered at St. Marys; 2,100 bbls. at Defiance; 1,510 bbls. Grand Rapids; 1,530 bbls. Maumee; 4,840 bbls. Toledo; 3,500 bbls. Russells Points, Logan Co.; 7,000 bbls. Middletown; 90 bbls. Lockland; 820 bbls. Crescentville; 600 bbls. Franklin; 500 bbls, Dayton; 160 bbls. Akron; 120 bbls. Massillon; 1,130 bbls. Zoar; 150 bbls. Bollvar, and 160 bbls. at New Philadelphia. Contract has been awarded to the SUPERIOR PORTLAND CEMENT CO., of Charleston, W. Va., at 97.19 cts. per bbl.

ASH-HANDLING PLANT.—Philadelphia, Pa.—Bids were received as follows on July 11, at the office of the Bureau of Yards and Docks, Washington, D. C., for constructing an ash handling and storage plant at the Philadelphia Navy Yard: Conveying Machinery Co., 120 Liberty St., New York, $33,364; Phil Lauthe Construction Co., 145 La Salle St., Chicago, $49,850; Hoisting Machinery Co., Arcade Bldg., Philadelphia, $36,300; Snare & Triest Co., 143 Liberty St., New York, $34,498; Bergen Point Iron Works, 149 Broadway, New York, $29,912; Link Belt Co., Nicetown, Philadelphia, $39,370; Belmont Iron Works, 2215 Washington Ave., Philadelphia, $32,000; Guarantee Construction Co., 140 Cedar St., New York, $37,750; Penn Bridge Co., Bond Bldg., Washington, $35,370; Edward F. Fonder, Land Title Bldg., Philadelphia, $28,884; Darley Engineering Co., 80 Broadway, New York, $12,840, and $9,537 on smaller plants.

GUN FORGINGS.—Washington, D. C.—Bids were received as follows by N. E. Mason, Ch. of Bureau of Ordnance, Navy Dept., Washington, on July 8 for furnishing (A) 16 sets 12-in.; (B) eight sets 8-in.; (C) 25 sets 6-in., and (D) 104 sets 3-in. nickel-steel gun forgings: Bethlehem Steel Co.—(A) 30 cts. per lb., (B) 30 cts., (C) 30 cts., (D) 40 cts.; Crucible Steel Co. of America—54 sets of (D) at 40 cts. per lb.; Midvale Steel Co.—(A) 30 cts per lb., (B) 30 cts., (C) 30 cts., (D) 40 cts.

Bids were received by Bureau of Ordnance as follows on July 3 for furnishing two sets of forgings for 14-in. rifle: Bethlehem Steel Co., South Bethlehem, Pa.—Carbon steel, 21 cts. per lb.; nickel-steel, 30 cts per lb.; first set in 90 days, complete in 120 days. Midvale Steel Co., Philadelphia, Pa.—Carbon-steel, 21 cts.; nickel-steel, 30 cts.; first set in three months, complete in four months.

Bids were also received on July 3 as follows for furnishing seven sets of 3.8-in. forgings for field howitzers: Bethlehem Steel Co., South Bethlehem, Pa.—$1 per lb.; commence in 60 days and complete in 120 days. Midvale Steel Co., Philadelphia, Pa.—$1 per lb.; commence in two months and complete in four months.

STEEL STEAMERS.—Washington, D. C.—Bids were received as follows on June 25 by the Quartermaster-General, U. S. A., Washington, D. C., for the construction and complete equipment of two, three or four twin-screw steel steamers for Submarine Mine Service of the War Department. (A) price for one vessel, (B) date for delivery of first vessel, (C) two vessels, (D) delivery two vessels, (E) three vessels, (F) delivery three vessels, (G four vessels, (H) delivery four vessels (bids all are for 1909 delivery): Union Iron Works, San Francisco, Cal., (B) June 10, 1909; (C) $388,000; (D), Aug. 1, 1909; (E) $579,000 (F), Oct. 1, 1909; (G) $770,500; (H) Dec. 1, 1909. Newport News Shipbuilding & Dry Dock Co., Newport News, Va., (B), May 1; (C) $351,000; (D) June 1; (E) $519,000; (F) June 15; (G) $686,000; (H) Aug. 1. The Gas Engine & Power Co. and Chas. L. Seabury & Co., Morris Heights, New York. (A) $198,000; (B) June 1. John H. Dialogue & Son, Camden, N. J., (A) $210,000; (B) May 20. Pusey & Jones Co., Wilmington, Del., (B) June 1, (C) $376,000; (D) Aug. 1. The United Engineering Works, San Francisco, (B) June 25; (C) $387,000; (D) Sept. 25. The Willamette Iron & Steel Works, Portland, Ore., (B) Aug. 1; (C) $417,000; (D) Oct. 1. The Maryland Steel Co., Sparrows Point, Md., (B) March 2; (C) $347,400; (D) March 22; (E) $514,450; (F) April 12; (G) $678,800; (H) May 3, ($4,000 deduction per boat if Portland cement). The Fore River Shipbuilding Co., Quincy, Mass., (B) April 12; (C) $379,000; (D) May 3; (E) $561,000; (F) May 24; (G) $745,000; (H) June 14. Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, (B) March 25; (C) $366,000; (D) April 26; (E) $544,000; (F) May 25; (G) 722,000; (H) June 26. The N. Y. Shipbuilding Co., Camden, N. J., (B) April 25; (C) $345,000; (D) May 25; (E) $499,000; (F) June 25; (G) $659,000; (H) July 25.

U. S. POSSESSIONS AND CUBA.

*CABLEWAYS.—Panama.—Bids are asked by Lieut.-Col. H. F. Hodges, Gen. Purchasing Officer, Isthmian Canal Commission, Washington, D. C., until 10.30 a. m., Aug. 7, for furnishing cableways.

TIE-PLATES.—Panama. — The Isthmian Canal Commission has awarded contract for furnishing 200,000 tie plates for 70-lb. rails to the UNITED STATES STEEL PRODUCTS EXPORT CO., 50 Church St., New York, at $12,739.

PIPE.—Panama.—The Isthmian Canal Commission, Washington, D. C., has awarded as follows contracts for engineering supplies: 86,500 ft. vitrified sewer pipe, $17,451, to AMERICAN SEWER PIPE CO., Pittsburg; 183,000 ft. wrought-iron pipe, to YOUNGSTOWN SHEET & TUBE CO., Youngstown, Ohio, at $47,063.

LUMBER, DYNAMITE, ETC.—Panama.—Bids are asked until July 21 by Lieut.-Col. H. F. Hodges, Corps Engrs., U. S. A., Purchasing Officer, Isthmian Canal Commission, Washington, D. C., for furnishing lumber and piles as per circular 452-A. Also, until July 27, for furnishing dynamite, connecting wire, steel, tobin bronze, yellow metal, copper, brass, brass and copper tubing, etc., as per circular 452.

BARGE.—Panama.—Bids were received as follows by the General Purchasing Officer, Isthmian Canal Commission, Washington, D. C., on July 3, for furnishing one submarine drill barge: Atlantic Equipment Co., $48,750, 165 days; J. H. Dialogue & Son, $50,000, 100 days, New York; Ellicott Machine Co., $54,400, 180 days; Fore River Shipbuilding Co., $41,470, 145 days; N. J. Foundry & Machine Co., $30,886, 175 days; Newport News Shipbuilding Co., $39,800, 205-210 days; Pusey & Jones, $36,000, 105-135 days; Maryland Steel Co., $34,000, 150 days; Canton Boiler & Engine Co., Canton, Ohio, $36,657, 150 days.

TIES AND LUMBER.—Panama. Bids were received as follows on July 6 for (a) 18,000 cypress cross-ties, and on July 7 for (b) a quantity of creosoted piles and (c) a quantity of creosoted lumber, for the Isthmian Canal Commission: For item (a)—A. S. Bacon & Co., Savannah, Ga., $16,020; G. S. Baxter & Co., 15 William St., New York, $14,040; W. P. Cook, 100 William St., New York, $13,680; G. Elias & Bro., Buffalo, N. Y., $14,220; Southern Trading Co., New Orleans, $19,800, $20,700; Union Lumber Co., San Francisco, $24,570; American Tie & Timber Co., New York, $13,752; $13,500; D. L. Gillespie & Co., Pittsburg, $12,690; Southern Sawmill Co., New Orleans, $22,230; Germain Co., Pittsburg, $14,040.

On (b) and (c): Arthur Gamwell, Seattle, Wash., (c) $12,202, (b) $29,200; Gulfport Creosoting Co., Gulfport, Miss., (b) $25,584; $25,628, (c) $14,010, $13,217; Norfolk Creosoting Co., Norfolk, Va., (b) $36,000; (c) $15,861; Puget Sound Wood Preserving Co., Lowell, Wash., (b) $46,180, (c) $19,694; Southern Creosoting Co., New Orleans, (b) $31,072, $29,853, (c) $16,257, $14,539; Southern Sawmill Co., New Orleans, (c) $12,883; West Pascagoula Creosoting Works, Gautier, Miss., (b) $24,891, (c) $13,176; Wyckoff Pipe & Creosoting Co., 50 Church St., New York, (c) $15,068.

CEMENT.—Panama.—Bids were received as follows by the Isthmian Canal Commission on July 2 for furnishing 12,000 bbls. of Portland cement: Alpha Portland Cement Co., $1.53 per bbl.; Alsen American Portland Cement Co., $1.78; American Trading Co. ("English Portland Cement"), $1.81; ATLAS PORTLAND CEMENT CO., New York, $1.52¼ (awarded contract—total, $18,270); Wm. Wirt Clark & Son ("Coplay Portland Cement"), $2.15; W. R. Grace & Co., $1.85; Lehigh Portland Cement Co., $1.57; Pacific Portland Cement Co., (delivery Benicia or South Valejo, Cal.), $1.72; Pennsylvania Cement Co., $1.92.

CONTRACT PRICES.

[Where * precedes items under Contract Prices the work was advertised in Engineering News.]

ASPHALT PAVING.—Seattle, Wash.—Bids were received by C. B. Bagley, Secy. Bd. Public Works, on July 3, for asphalt paving on Roy St., 16th Ave. North, etc. In details, bids were as follows: (A) F. McClellan & Co., Burke Bldg., Seattle; (B) Barber Asphalt Paving Co., Mutual Life Bldg., Seattle; (C) Independent Asphalt Paving Co., Pioneer Bldg., Seattle; (D) P. J. McHugh, Seattle; (E) Rich & Harris Construction Co., Seattle:

Roy St.—	(A)	(B)	(C)
Fixed Estimate	$8,000.00	$8,000.00	$8,000.00
Clearing and grubbing (lump sum)	5,000.00	1,500.00	4,000.00
27,200 cu. yds. sub-grading	.40	.70	.75
2,708 lin. ft. 8" sewer pipe	1.40	1.50	1.40
650 lin. ft. 6" sewer pipe	1.00	1.25	.90
7 4½-ft. manholes	75.00	65.00	50.00
4 3½-ft. manholes	70.00	60.00	45.00
15 catch basins, 1 inlet	60.00	75.00	60.00
4 catch basins, 2 inlets	70.00	80.00	70.00
257 lin. ft. granite curb, curved	2.00	2.00	1.80
257 lin. ft. armored concrete curb (alternative)	1.50	1.00	1.20
27,739 lin. ft. concrete curb	.40	.38	.45
4,749 sq. yds. concrete walks	1.20	1.15	1.30
24,605 sq. yds. paving, asphalt	2.04	2.03	2.05
14,668 sq. yds. paving, sandstone	3.85	4.00	4.10
355 sq. yds. paving, surfaced concrete	2.00	2.20	1.65
5,396 sq. yds. brick gutters	2.70	2.85	3.00
544 lin. ft. wood stop	.60	.40	.50
27 monument cases	10.00	10.00	10.00
4 flush tanks	120.00	100.00	100.00
40 catch basins, moved	20.00	25.00	30.00
2 new inlets	25.00	15.00	15.00
43 inlets to be moved	10.00	3.50	5.00
26 manholes, catch basins, etc., to be adjusted	5.00	2.50	3.00
1,330 lin. ft. 3" sewer pipe	.30	.20	.30
1,432 lin. ft. 3" tile drain	.25	.15	.30
681 lin. ft. concrete stairway	.80	.80	1.40
171 lin. ft. concrete high parapet	.80	1.75	2.50
256 lin. ft. galvanized hand-rail	.30	1.75	2.00
1,620 lin. ft. 6" sewer pipe	1.00	2.10	2.50
500 sq. yds. 4" gravel base	.15	.25	.30
500 sq. yds. 1" extra concrete base	.20	.20	.20
10 M. ft. B. M. relaying old lumber	7.00	5.00	5.00
1,518 lin. ft. 8" c.-i. pipe, "A"	1.50	1.60	1.55
1 8" gate	35.00	25.00	30.00
2 8" district gates	40.00	27.50	35.00
4 hydrants	80.00	75.00	80.00
4 brick gate chambers	60.00	35.00	40.00
18 ft. 6" c.-i. pipe, hydrant connections	1.00	1.25	1.10
100 lin. ft. ¾" galvanized pipe	.20	.25	.50
Totals, Granite Curb	$178,417	$187,430	$197,497
Totals, Armored Concrete Curb	$178,288	$187,173	$197,343

16th Ave. North—	(D)	(E)	(C)	(B)
Fixed estimate	$9,000.00	$9,000.00	$9,000.00	$9,000.00
Clearing and grubbing (lump sum)	2,000.00	4,000.00	5,000.00	3,000.00
33,350 cu. yds. sub-grading	.60	.40	.50	.75
8 catch basins, 1 inlet	55.00	70.00	60.00	70.00
4,362 lin. ft. curb, curved granite	2.00	2.10	1.80	2.10
48,717 lin. ft. curb, concrete	.40	.50	.40	.45
56,239 sq. yds. paving, asphalt	1.85	1.98	1.98	2.20
11,477 sq. yds. paving, sandstone	3.85	3.50	3.80	4.20
13,780 sq. yds. 1" additional concrete base	.20	.15	.20	.20
8,675 sq. yds. brick gutters	2.90	2.80	2.80	3.10
1,000 lin. ft. wooden stop	.50	.50	.50	.45
3 new inlets	20.00	15.00	15.00	20.00
125 inlets to be moved	3.00	2.00	5.00	3.50
48 catch basins to be moved	25.00	25.00	30.00	30.00
22 catch basins rebuilt	30.00	30.00	30.00	35.00
109 adjusting manholes, flush tanks	2.00	2.00	3.00	2.50
812 sq. yds. alley crossings, concrete	1.50	1.35	1.60	1.20
56 monument cases	10.00	10.00	10.00	10.00
1,000 lin. ft. 3" sewer pipe	.25	.25	.35	.20
12 M. ft. B. M. planking	15.00	18.00	18.00	17.00
20 M. ft. B. M. old planking, relaid	5.00	5.00	5.00	5.00
1,000 sq. yds. 4" gravel base	.30	.30	.20	.35
550 lin. ft. 6" c.-i. pipe, "A"	2.00	1.30	1.35	1.60
40 lin. ft. 8" c.-i. pipe, "A"	2.20	1.50	1.55	2.00
4 hydrants	100.00	90.00	80.00	80.00
15 lin. ft. 6" c.-i. pipe, hydrant connections	2.00	1.30	1.25	1.50
39 brick gate chambers	35.00	35.00	35.0	35.00
1 cast-iron gate box, 2" gate	5.00	5.00	5.00	5.00
100 lin. ft. ¾" galvanized pipe	.60	.07	.50	.25
1,470 sq. yds. concrete walks	1.30	1.20	1.30	1.20
Totals	$245,863	$247,339	$250,782	$279,928

***ASPHALT PAVING, SUBWAYS.**—Auburn, N. Y.—Bids were received by C. August Koenig, Mayor, on July 7 for paving William St. and Garden St. with standard asphalt and constructing subways in these streets. J. S. Hanlon is City Clk. Bidders and bids in detail were as follows: (A) Warner-Quinlan Asphalt Paving Co., Syracuse, N. Y.; (B) Brayer Bros., Auburn, N. Y.; (C) Barber Asphalt Paving Co., 30 Church St., New York; (D) Guy M. Gest, 277 Broadway, New York; (E) Wm. P. Holihan, Auburn; (F) Jerry Corkery, Auburn.

Paving Garden St.—

	(A)	(B)*	(C)
4,500 sq. yds. of asphalt	$2.33	$2.20	$2.35
1,800 lin. ft. of limestone curbing	.95	.99	.99
275 lin. ft. of curved limestone curbing	.95	1.50	1.00
1,830 lin. ft. of sandstone curbing	.86	.95	.90
275 lin. ft. of curved sandstone curbing	.86	1.50	.95
2,100 lin. ft. of concrete curb and gutter	1.00	.85	.95
300 lin. ft. of headers	.60	.65	.65
7 catch basins, new	60.00	65.00	65.00
1 catch basin to repair	25.00	25.00	25.00
1,000 sq. ft. of old walk to be relaid	.05	.04	.04
1,000 sq. ft. of new walks to be laid	.14	.16	.20
100 sq. yds. of brick pavement	2.70	3.00	3.10
Total	$13,606	$13,338	$13,926

Working days—(A) 90 (for all), (B) 60 (for all), (C) 100.

Paving William St.—

	(A)	(B)*	(C)
3,800 sq. yds. of asphalt	$2.33	$2.20	$2.35
1,900 lin. ft. of Auburn grey limestone curbing	.95	.99	.99
160 lin. ft. of curved auburn gray limestone curbing	.95	1.50	1.00
1,900 lin. ft of medina sandstone curbing	.86	.95	.90
160 lin. ft. of curved medina sandstone curbing	.86	1.50	.95
2,060 lin. ft. of concrete curb and gutter	1.00	.85	.95
240 lin. ft. of limestone headers	.60	.65	.65
5 catch basins connected complete	60.00	65.00	65.00
3 catch basins to be repaired	25.00	25.00	25.00
1,000 sq. ft. of old walks to be relaid complete	.05	.04	.04
1,000 sq. ft. of new walks to be laid complete	.14	.16	.20
Total	$11,520	$11,237	$11,767

Working days—(A) 90 (for all), (B) 60 (for all), (C) 100.

Subway in Garden St.—

	(D)	(E)	(B)	(A)
2,400 lin. ft. of 6 duct tile	$1.05	$0.78	$0.87	$0.99
1,500 lin. ft. str. iron pipe	.70	.31	.34	.36
40 iron pipe bends	4.00	.85	1.50	8.00
7 double manholes	335.00	290.00	195.00	150.00
1 single manhole	210.00	200.00	100.00	100.00
Extra excavation, per cu. yd	1.25	.80	.80	.50
Extra brick per 1,000	20.00	15.00	16.50	10.00
Extra P. C. concrete, etc., per cu. yd.	8.00	6.00	8.00	5.00
Total	$6,285	$4,601	$4,123	$4,386

Working days—(D) 50, (E) 30, (B) 60 (for all), (A) 90 (for all.)

Subway in William St.—

	(D)	(E)	(F)	(B)	(A)
2,050 lin. ft. of 6 duct tile	$1.05	$0.78	$0.78	$0.87	$0.99
2,760 lin. ft. of iron pipe	.70	.31	.37	.34	.36
50 iron pipe bends	4.00	.85	4.50	1.50	8.00
4 double manholes	335.00	290.00	481.00	195.00	150.00
1 single manhole	210.44	200.00	310.00	100.00	100.00
Extra excavation, per cu. yd	1.25	.80	.60	.80	.50
Extra brick per 1,000	20.00	15.00	22.50	16.50	10.00
Extra P. C. concrete, etc., per cu. yd.	8.00	6.00	6.50	8.00	5.00
Total	$5,834	$3,857	$5,070	$3,677	$4,123

Working days—(D) 50, (E) 30, (F) no time given, (B) 60 (for all), (A) 90 (for all.)

Note: *Brayer Bros. will deduct 10 cts. per sq. yd. if the guarantee is for 8 yrs. instead of 10 yrs.

REGRADING STREET.—Seattle, Wash.—Bids were received as follows on June 27 by C. B. Bagley, Secy. Bd. Public Works, for regrading Olive St. Bidders were: (A) C. J. Erickson, 1512 Fifth Ave., Seattle; (B) John Kalberg & Co., Seattle; (c) HAWLEY & LANE, Fourth Ave. and Olive St., Seattle (awarded contract); (D) Holt & Jeffery, 310 Hinckley Bldg., Seattle:

	(A)	(B)	(C)	(D)
Fixed estimate	$3,000.00	$3,000.00	$3,000.00	$3,000.00
Clear and grub., lump sum	5,000.00	800.00	1,000.00	5,000.00
Earthwork, 191,800 cu. yds.	.30	.20	.18	.17
Curbs and gutters, 161 M. ft. B. M.	15.00	20.00	17.00	18.00
Crosswalks, 21 M. ft. B. M.	15.00	20.00	17.00	18.00
Concrete walks, 5,050 sq. yds.	1.40	1.15	1.15	1.10
Alley crossings, concrete, 295 sq. yds.	1.40	1.30	1.25	1.30
12 catch basins, 2 inlets	80.00	75.00	65.00	80.00
27 catch basins, 1 inlet	70.00	65.00	50.00	66.00
8 single inlets	30.00	30.00	25.00	20.00
3" sewer pipe, 400 lin. ft.	.25	.15	.25	.15
6" sewer pipe connection, 40 ft.	.75	.90	.75	1.50
8" sewer pipe connection, 20 lin. ft.	.80	1.00	1.00	1.60
12" pipe sewer, 1,098 lin. ft.	1.50	1.50	1.20	3.40
18" pipe sewer, 404 lin. ft.	3.75	3.00	2.00	4.00
21" pipe sewer, 488 lin. ft.	4.50	3.50	2.50	5.00
4½-ft. manholes	75.00	60.00	75.00	90.00
9 extra manholes	30.00	40.00	60.00	50.00
Temp. structures, 20 M. ft. B. M.	15.00	5.00	20.00	21.00
Totals	$85 982	$61,089	$56,015	$62,994

HARBOR WORK.—Sicily.—The Italian Government has made the following appropriations for harbor improvements in Sicily: Port Augusta, $200,000 for a jetty; Licata, $10,000 for a quay; Lipari, $8,000 for a breakwater; Marsala, $40,000 for continuation of work in hand; Messina, $240,000 for quays; Riposto $200,000 for mole works; Sciacca, $20,000 for a breakwater; Siracusa, $200,000 for jetty and quays; Terminl, $200,000 for lengthening mole and building a jetty; Terranova, $15,000 for a jetty; Mazzaro, $50,000 for a breakwater; Maretimo (Island), $9,000 for a jetty; Castellammare Golfo $10,000 for excavation of rocks; Milazzo, $16,000 for breakwater.

DREDGING.—Spain.—Bids are asked until 2 p. m., Oct. 14, at the Junta de Obras del Puerto, 14 Calle Vasques Lopez, Huelva, for dredging at Huelva. A deposit of 60,000 pesetas (about $12,000) will be required if the bid is for the execution of the work, and 5 per cent. of the value if the bid is for the supply of the material. The former deposit must be raised to 300,000 pesetas (about $60,000) by the successful bidder and the latter to 10 per cent. of the value. A term of six years will be allowed for the execution of the dredging work, if that is contracted for, and payment will be made at the rate of 500,000 pesetas (about $100,000) annually. The dredging material for which bids are invited alternatively includes one rotary dredger, four barges and one suction pump. Local representation is necessary.

ELECTRIC PLANT.—Chile.—Bids are asked until 3 p. m., Nov. 2, by the Director-General of State Railways, at Santiago, for the construction of an electric plant at San Eugenio, comprising the building and the machinery for the production of motor force in the shops and the lighting of the stations, with a capacity of 900-KW., divided into three units of 300 each. No proposals will be considered that are not made upon the form that will be found in duplicate on the leaf of specifications furnished free of charge by the engineer of the technical office upon a deposit of 60 pesos with the central cashier of the service. The work must be executed in conformity with these specifications.

PUBLIC BUILDINGS.—Jamaica.—Designs and estimates of quantities for the proposed new public buildings, which are to be constructed of reinforced concrete, are in the hands of the Director of Public Works at Kingston. Firms desiring to have an opportunity of bidding on this work should address the Director of Public Works on this subject. Building laws and projects in Jamaica were noted in this column on May 2, 1907, and Oct. 24, 1907.

FOREIGN CONTRACTS.

(To insure prompt attention, letters upon consular business should be addressed to the American Consul at ———, ——— Such letters are opened and attended to by the person that may be in charge of the office. If addressed to the consul, personally, letters are forwarded to him, unopened, should he be absent, and a delay thus intervenes. If, in the meantime, he should have gone out of office the matter may wholly escape attention.)

RAILWAY MATERIAL.—Siam.—Bids are requested by the Royal Siamese State Railways, Bangkok, until 10 a. m., Oct. 1, for the following material: 75,000 pairs of fishplates; 300,000 fishbolts and nuts; 2,100,000 spikes; 270,000 bearing plates; 360,000 spring washers of crucible steel; all of mild Bessemer steel. (Noted on June 11.)

RAILWAY EXTENSION.—Barbados, West Indies.—Arthur J. Clare, U. S. Consul, reports from Bridgetown that the Barbados Light Ry. Co. is preparing a petition to the Legislature of the island to enable it to build a new line from Bridgetown to the Parish of St. Peter. He states that the railway extension would develop commerce and property on the western coast of Barbados.

ENGINEERING MATERIAL PRICES.

TRACK FASTENINGS—

Pittsburg, f. o. b. cars—Angle bars, 1.65 to 1.75 cts.; spikes, 2.25 to 2.45 cts.; bolts, square nuts, 2.65 to 2.75 cts.; bolts, hexagonal nuts, 2.80 to 2.90 cts.

RAILS, STEEL—

New York—at mill—New standard sections, $28; standard, second quality, $27 to $28; light sections, 12 to 14 lbs., $34 to $36; old iron rails, f. o. b. New York, $17 to $18; old steel rails, short lengths, $11 to $11.50; old steel rails, re-rolling lengths, $11 to $12.

Pittsburg—Standard sections, at mill, $28; standard, second quality, $27 to $28; light rails, 25 to 45-lb., $28; 20-lb., $29; 16-lb., $38; 12-lb., $32; 10-lb., $34, and 8-lb., $38.

STRUCTURAL MATERIALS—

New York—at tidewater—Beams, channels, angles and zees, 1.86 cts.; tees, 1.90 cts.; On beams, 18 to 24-in., and angles over 6-in., the extra is 10 cts. Material cut to length is sold from stock at 2¼ cts. to 2½ cts.

Pittsburg—Beams and channels up to 15-in., 1.76 cts.; over 15-in., 1.86 cts.; angles, 3 × 2 × ¼-in. thick, up to 6 × 6-in., 1.70 cts.; 8 × 8 and 7 × 3½-in., 1.80 cts.; zees, 3-in. and larger, 1.70 cts.; tees, 3-in. and larger, 1.75 cts.; bulb angles and deck beams, 2 cts. Under the Steel Bar card angles, channels and tees under 3-in., are 1.70 cts., base, for Bessemer and open hearth, subject to half extras on the Standard Steel Bar card.

PLATES AND SHEETS—

New York—at tidewater—The following prices are based on carload lots, with 5 cts. extra for less than carload lots. Terms, net cash in 30 days:

Tank plates, 6¼ to 14 ins. wide	$1.76 to $1.86
14½ to 100 ins. wide	1.86 to 1.96
Flange and boiler test	1.86 to 1.96
Marine	2.06 to 2.16
Locomotive fire-box	2.06 to 2.16
Still bottoms	2.85 to 3.10

Note—Plates more than 100 ins. in width, 5 cts. extra per 100 lbs.; plates 9-16 in. in thickness, $2 extra; Nos. 7 and 8 gage, $3 extra; No. 9, $5 extra.

Pittsburg—tank, ¼-in. thick and heavier, 1.70 to 1.80 cts.; black sheets, 27-gage, 2.50 to 2.55 cts.; black sheets, 28-gage, 2.60 to 2.65 cts.

IRON—

Pig Iron:
At New York—tidewater—

Northern—	
No. 1 X foundry	$16.25 to $17.00
No. 2 X foundry	15.75 to 16.50
No. 2 plain	15.25 to 16.00
Gray forge	14.50 to 15.00
Basic	15.25 to 15.50
Virginia—	
No. 1 foundry	16.60 to 17.10
No. 2 foundry	16.10 to 16.60
Basic	15.60 to 16.10
Southern—	
No. 1 foundry	16.75 to 17.25
No. 2 foundry	16.25 to 16.75
No. 3 foundry	15.75 to 16.25
No. 4 foundry	15.25 to 15.75
No. 1 soft	16.75 to ....
No. 2 soft	16.25 to ....
Gray forge	14.75 to 15.25
Mottled	14.00 to 14.50

At Chicago—

Lake Superior Charcoal	20.00 to 20.50
Northern—	
Coke Foundry, No. 1	18.00 to 18.50
Coke Foundry No. 2	17.50 to 18.00
Coke Foundry No. 3	17.00 to 17.50
Scotch No. 1	18.50 to 19.00
Southern—	
Coke, No. 1	16.85 to 17.35
Coke, No. 2	16.35 to 16.85
Coke, No. 3	15.85 to 16.35
Coke, No. 4	15.35 to 15.85
Coke No. 1 Soft	16.85 to 17.35
Coke, No. 2 Soft	16.35 to 16.85
Gray Forge	14.35 to 14.85
Mottled	14.10 to 14.60
Malleable Bessemer	17.50 to 18.00
Standard Bessemer	18.40 to 18.90
Jackson County—	
and Kentucky Silvery, 6%	19.90 to 20.40
and Kentucky Silvery, 8%	20.90 to 21.40
and Kentucky Silvery, 10%	22.90 to 23.40

Cast-Iron Pipe:

New York—Carload lots, net tons, 6-in., at tidewater, $25 to $25.50.

Chicago—4-in. water pipe, $27; 6-in. to 12-in., $26; over 16-in., $25, with $1 extra for gas pipe.

MISCELLANEOUS MATERIALS—

Copper:
Lake, 12.75 to 12.87½ cts.; electrolytic, 12.50 to 12.75 cts.; casting, 12.37½ to 12.50 cts.
Lead: New York, spot, 4.42½ to 4.45 cts.
Spelter: New York, spot, 4.45 to 4.50 cts.
Tin: New York, spot, 28.25 to 28.75 cts.

Readers' Wan

If you are in the market for equipment or supplies, and fail to in our advertising pages, send us ticulars, and we will gladly put touch with the right parties.

TRADE CATALOGS.—Fort Dodge, J. Scofield, Ft. Dodge, Ia., writes that he desires trade catalogs per municipal and general engineering

PAINT REMOVER.—Cedar Rapids are requested by Bartlett & Kl Rapids, Ia., to give the names of for removing old paint from a highway bridge.

CONTRACTOR'S EQUIPMENT York, N. Y.—We are advised by Dana, C. E., 15 William St., New Y he desires catalogs and information ing contractors' supplies of every de

WATER-WORKS AND SEWERA PLIES.—Fallon, Nev.—We are in re letter from E. P. Osgood, Fallon, N ing that he desires to secure cat information concerning water-wor sewerage systems.

CIVIL SERVICE EXAMINATIONS.

CERAMIC CHEMIST.—Washington, D. C.—An examination will be held by the U. S. Civil Service Commission on June 24 to secure eligibles from which to make certification to fill a vacancy in the position of Ceramic Chemist in the laboratory of the United States Geological Survey, at $1,980 to $3,600 a year, according to the rating received, and vacancies requiring similar qualifications as they may occur in any branch of the service. No merely scholastic or clerical tests will be given, and competitors will not be assembled for examination. Age limit, 21 years or over. Application Form 304 and special form.

LEVELER, ENGINEER, ETC.—Albany, N. Y.—The New York State Civil Service Commission will hold examinations on July 25 for the following positions: Assistant in Economic Geology, State Museum, $1,200; Conductor of Farmers' Institutes, $5 to $10 a day; Engineering Examiner, Civil Service Commission, $1,000 to $1,200; Index Clerk, Westchester County Clerk's Office, $25 a week; Interpreter, Supreme Court, New York County, $2,500; Leveler, $4.50 to $5 a day; Slavonic Interpreter, Kings County Service, $1,800 to $2,500; Structural Engineer, State Architect's Office, $2,000. The last day for filing applications for these positions is July 18. Full information and application forms for any of these examinations may be obtained by postal card request to Charles S. Fowler, Chief Examiner, of the Commission at Albany.

ASSISTANT CHEMIST.—Washington, D. C.—The U. S. Civil Service Commission announces the postponement to July 29-30, of the examination scheduled for July 15-16, to secure eligibles from which to make certification to fill vacancies as they may occur in the position of Assistant Chemist, at salaries ranging from $1,200 to $1,800 a year, in the Bureau of Chemistry, Dept. Agriculture. It is probable that 15 or 20 appointments may be made within the next few months. The Department states that the higher salaries will be paid only to those who have had first-class training and considerable experience at miscellaneous work other than that obtained in a college or university course in chemistry, and that recent graduates and chemists who have not had wide and varied experience in analytical work may expect the possibility of the lower salaries. It is also stated by the Department that men experienced in tannery chemistry and paper-making chemistry will probably be needed in the near future. Persons having experience along these lines are therefore requested to set forth such experience fully in their applications. Age limit, 20 years or over. Application Form 1312. Applications must be filed before closing hour on July 20.

INDUSTRIAL NOTES.

THE WYCKOFF PIPE AND CREOSOTING Co. has removed its main offices from Stamford, Conn., to 50 Church St., New York City.

THE HENRY R. WORTHINGTON CO., of New York and Chicago, reports the sale of a horizontal, two-stage turbine pump of 2,500,000 gals. capacity to the Water-Works Board of Elgin, Ill.

THE GENERAL FIREPROOF CO., Youngstown, Ohio, states that it is preparing to erect an additional factory building, 60 × 200 ft. This building will be devoted to the manufacture of steel office furniture and filing devices.

THE TRENTON IRON CO., Trenton, N. J., offers a number of cash prizes for pictures of installations of wire rope tramways of the Bleichert system. The awards will be made on October 15, 1908, and all correspondence should be addressed to "The Trenton Iron Co., Trenton, N. J.," and marked "For Prize Competition."

LACLEDE-CHRISTY CLAY PRODUCTS Co., St. Louis, Mo., announces the acquisition of the business, property and good will of the Jamieson-French Fire Clay Co., Lake Junction, St. Louis County, Mo. Mr. Henry K. Lackland, formerly Secretary and General Manager of the above company, will be associated with the Laclede-Christy Company in the capacity of manager of the high-grade clay department.

ANNOUNCEMENT IS MADE that the Cutler-Hammer Mfg. Co. of Milwaukee, makers of electric controlling devices, has just completed arrangements whereby this firm will be represented on the Pacific Coast by

& Squires, 111 New Montgomery St., San Francisco, ... A. W. Vinson, who has for several y... been connected with the Engineering ... partment of the Cutler-Hammer Mfg. Co., ... been transferred to the office of Otis ... quires, where his services will be availa... to those confronted with problems of ... cle control which cannot be met by the u... of standard apparatus.

THE ... KMAN-DUTY BRICK CO. announces ... consolidation of the Malvern Clay Co., ... Malvern, Ohio, with the Collinwood-Dec... an-Duty Co., with plants at Collinwood ... Carrollton, Ohio. The name of the new ... pany is the Deckman-Duty Brick Co., with ... neral offices at 854-856-858 Rose Bldg., C... and, Ohio. The management of the new ... mpany, and its plants, will be under the ... rsonal direction of Messrs. Chas. J. Deckm... and Spencer M. Duty, who individually ... ave heretofore managed the Malvern Cla... o. and the Collinwood-Deckman-Duty Co... The officers of the new company are: Sp... r M. Duty, Pres.; Chas. J. Deckman, V... Secy., Mgr. of Sales; Herbert C. Moatz, ...s.

THE FERGUSON CONTRACTING CO., of 37 Wall ..., New York, has just closed a contract ... h one of the oldest and largest phosphat... ompanies in Florida for excavating all ... the material overlying its large beds of ... osphate. This work will involve from 12 ... 20 million cu. yds. of excavation, and will ... ke at least six years to complete. The plan... that the contractor will use will be the m... t modern type, including the largest size ... steam shovels with locomotives and cars to ... t. The contractor now has a part of the plant on the work and expects to have the entire equipment necessary to do this work on the ground within the next few weeks, as orders have been placed for all additional plant required.

THE LONDON COUNTY COUNCIL has awarded a contract to the Trinidad Lake Asphalt Co., Ltd., to pave the Thames Embankment with sheet asphalt. This is the outcome of two years of experimentation, during which the Trinidad comapany, among others, laid trial pavements of a few hundred yards. The order just given to one of the constituent concerns of the General Asphalt Co. of Philadelphia, is for 6,500 yards. While drays and heavy wagons are prohibited on the Thames embankment, the number of cabs, motors and other vehicles that pass over it probably exceeds the traffic over any other thoroughfare in the world. The pavement is to be constructed by removing three or four inches from the surface of the existing macadam, and then laying two inches of dense binder course, on which will be placed one and one-half inches of the regular surface mixture usd on the best asphalt pavment in this country.

TRADE PUBLICATIONS.

SPRING SEAT VALVES.—Crosby Steam Gage & Valve Co., 16 Dey St., New York City. Paper; 4 × 8 ins.; pp. 8; illustrated.

These valves are composed of parts which are all interchangeable, and are guaranteed not to leak at high pressures.

A NEW STEAM TRAP.—Richard J. Flinn, West Roxbury, Mass. Paper; 6½ × 9 ins.; pp. 4; and folder, 3¼ × 6 ins.; pp. 8; illustrated.

A differential trap for draining water of condensation from steam or air pipes, cylinders, receivers, etc., has been devised and placed on the market by the inventor.

CYANIDE PLANT EQUIPMENT.—Redwood Manufacturers Co., Balboa Building, San Francisco, Cal. Catalog No. 3. Paper; 6 × 9 ins.; pp. 48; illustrated.

Redwood tanks for leaching, clean-up, water and other purposes, wooden pipe, launders and zinc boxes form the general stock manufactured by the company. They furnish solution, vacuum and sand pumps, filters, zinc shavings, cyanide and all other fittings indicated by the title of the catalog.

RAILWAY TRACK-WORK.—The Indianapolis Switch & Frog Co., Springfield, Ohio. Paper, with binder; 9 × 12 ins.; pp. 84; illustrated.

A number of standard and special designs of track work are shown, including crossings, frogs, switches, stands and accesories. Particular attention is called to the use of full section of rail instead of flat guard, as a method of guarding on tongue and switch construction for street railways.

STREET CONSTRUCTION AND MAINTENANCE MACHINERY.—Various Circulars and Folders. Briggs Labor Saving Specialty Co., Waterloo, Iowa.

A calendar illustrates and briefly describes a street sweeper which carries its own sprinkler and dumps the dirt for ready loading. Various dump carts for removing street dirt, etc., and for a variety of other purposes are described in other circulars, as well as asphalt, fire and hauling wagons and concrete spreaders.

STEEL RAIL SPECIFICATIONS AND SECTIONS.—The American Bureau of Inspection and Tests, New York City. Paper; 3¼ × 6¼ ins.; pp. 20; illustrated.

This firm of consulting and supervising engineers, who make a specialty of rail testing, have issued in booklet form the "Specifications for Steel Rails," as recommended by the American Railway Association, the "American Standard Specification for Relaying Rails" and the "Report on Standard Rail and Wheel Sections" of the American Railway Association.

TANKS AND MILL SUPPLIES.—Pacific Tank Co., Los Angeles, Cal. Catalog No. 7. Paper; 6 × 9 ins.; pp. 128; illustrated.

The complete catalog of this company includes a large variety of tanks, especially such types as are applicable to mining purposes in cyanide and other mills, filter presses, solution pumps, distributors and wooden piping. Their method of use is illustrated by cuts of fully installed mills and slime plants.

WINDMILLS.—Flint & Walling Mfg. Co., Kendallville, Ind. Catalog No. 57. Paper; 6 × 8 ins.; pp. 46; illustrated.

The "Star" windmills are described in this booklet as possessing all desirable qualities of such mechanisms; correct workmanship, simplicity and strength. Irrigating pumps and steel towers for various purposes, such as tank substructures, are also announced as part of the company's regular stock.

RIVETING MACHINES.—John F. Allen, 370 Gerard Ave., New York City. Paper; 6 × 9 ins.; pp. 31; illustrated.

This firm builds portable pneumatic percussion and compression riveting machines for structural bridge and railway work, boiler, tank and stack construction. It is claimed that the boiler riveter can be purchased at half the cost of steam or hydraulic riveting machines having the same reach, and that it makes tighter work and drives as many rivets as any hydraulic, steam or power riveter.

CORE DRILLS.—The Cyclone Drill Co., Orrville, Ohio. Paper; 6 × 9 ins.; pp. 82; illustrated.

A well prepared booklet calls attention to chilled steel shot as an acceptable substitute for diamonds as the cutting agent of core drills. The cyclone Drill Co. claims that its method has been practically demonstrated not only equal but superior, especially in difficult, broken rock, to all other drilling methods. Both hand and steam power equipments are listed.

REFUSE DISPOSAL PLANTS.—Lewis & Kitchen, 1200 Michigan Ave., Chicago, Ill. Catalogs Nos. 1 and 2. Paper; 12 × 9½ ins.; pp. 12 and 24; illustrated.

This firm designs and constructs municipal sanitary works and garbage incinerating plants. These can be and are erected in the heart of a town's residential district, as no noxious fumes are evolved by the patented system of these constructors and the architectural exterior of the plant can be molded to pleasing lines.

FOUNDRY EQUIPMENT.—Whiting Foundry Equipment Co., Harvey, Ill. Paper; 6 × 9 ins.; pp. 32; illustrated.

This is a general catalog covering a variety of machinery and apparatus. It includes cupolas, car dumping machines for charging cupolas, traveling and jib cranes, air hoists, tumblers for cleaning castings, ladles of all sizes, industrial railways and cars, an overhead trolley carrier system, core ovens, etc. A partial list is given of plants equipped by this company.

FERRO-LITHIC PLATES.—Berger Manufacturing Co., Canton, O. Paper; 6 × 9 ins.; pp. 24; illustrated.

The "Ferro-Lithic" roof slab is designed to meet the demand for a fireproof roof structure. It is said to be especially suitable for buildings exposed to smoke, acid fumes, gases and condensation of moisture. The system consists of corrugated, cross-ribbed, 24-gage steel plates, concreted on top and plastered underneath. In curved form these plates are adapted to floors sustaining heavy load, as in schools, factories, warehouses, bridges, etc.

SUBAQUEOUS ROCK CUTTERS.—Lobnitz & Co., Ltd., Renfrew, Scotland; Carr Bros., New York City, American agents. Catalog No. 7. Paper; 9 × 11 ins.; pp. 16; illustrated.

This rock cutter works without explosives. It consists of a heavy chisen of compressed steel weighing from 10 to 15 tons and fitted with a hard cutting point. This is allowed to fall from 6 to 10 ft. upon the rock. One ton of coal and the labor of four men is required, with an average result of 100 cu. ft. of rock broken per day.

SURVEYING INSTRUMENTS AND DRAWING MATERIALS.—Iszard Warren Co., 1122 Vine St., Philadelphia, Pa. Paper; 6 × 9 ins.; pp. 227; illustrated.

The first complete catalog issued by this newly organized firm of instrument makers describes "a line of the Highest Grade Precision Instruments, absolutely guaranteed and sold at moderate prices." Among the novelties offered is a "Midget" transit, which may be carried in a suitcase; 3½-in. horizontal circle, 2¾-in. vertical circle, weight, 6 lbs. It is complete in all appointments, being intended for exploring expeditions and consultation engineering.

HOISTING MACHINERY.—The National Equipment Co., Chicago, Ill. Paper; 6 × 9 ins.; pp. 40; illustrated.

A wide variety of machinery is included in this catalog. There are steam, electric and gasoline hoisting engines, derricks and derrick fittings, drop-bottom and clamshell buckets, pneumatic motor and cylinder hoists and lifting magnets. Other specialties include dump cars and wagons, concrete mixers, pumps and a portable stone crushing machine with conveyor attachment.

PORTABLE STEAM HOISTING ENGINES.—John F. Byers Machine Co. Ravenna, O. Catalog No. 11. Paper; 9 × 11 ins.; pp. 75; illustrated.

This catalog lists a variety of portable and semi-portable steam hoisting engines, geared locomotives, derrick cars, and blocks and sheaves for contractors and quarrymen. The engines are of vertical, self-contained type, with plain flue boilers, made of open-hearth steel. The makers have aimed at an unusually convenient arrangement of all operating parts.

WIRE ROPE FOR UNDERGROUND HAULAGE.—Broderick & Bascom Rope Co., St. Louis, Mo. Paper; 9½ × 12½ ins.; pp. 28; illustrated.

Practical applications of the tail rope system to the haulage of coal cars in mines, are described and illustrated with sketches and half-tone photographs of actual operations. The Broderick Bascom Co. also issues a monthly 12-page bulletin under the title "The Yellow Strand." This is devoted to news of advertising value to the firm's products and to interesting miscellaneous reading matter.

LARGE SIZE SHAFTING AND DRILL BITS.—Fried. Krupp, Essen, Germany. Paper; 8 × 5½ ins.; pp. 45; illustrated.

Among other long shafts, that of the liner "Kaiser Wilhelm der Grosse," measuring a total length of 71 meters, of which 45m. are a one-piece forging, is described with its process of manufacture. Steel teeth for 8-ton and heavier trepans, as used in mine shaft sinking by the Kind-Chandron process are also listed. These forgings are described as a portion of the Krupp exhibit at Dusseldorf, in the 1902 exhibition.

DIPPER DREDGES.—The Fairbanks Steam Shovel Co., Marion, Ohio. Paper; 9 × 6¾ ins.; pp. 63; illustrated.

Steam shovels, dredges, ditching machines, locomotive cranes and traction engines, as built by this firm, are claimed by them to be of such superior design and workmanship as to have attained merited popularity, instanced by the fact that their dipper dredges compose 75% of the total number built during the last four years in the United States. The catalog continues a number of half-tones of machines working in difficult situations.

CEMENT AND VITRIFIED PIPE FOR SEWERS.—A. L. Bowers, C. E., Pittsburg, Pa. Paper; 5 × 8 ins.; pp. 51; illustrated.

Mr. Bowers issues in pamphlet form a discussion on the comparative merits of vitrified salt glazed and concrete pipe for sewerage systems, bringing a number of arguments and facts to show that the former is the superior material. He says that cement is porous, soluble in acids and alkalies and unable to resist bacterial agencies, whereas vitrified pipe, being composed largely of silica, is absolutely impervious and withstands all corroding influences.

CONCRETE REINFORCEMENT, STEEL FURNITURE AND FITTINGS.—The General Fireproofing Co., Columbus, Ohio. Paper; 6 × 9 ins.; pp. 12; illustrated.

This pamphlet contains brief descriptions of the company's specialties. For concrete reinforcement there are twisted steel lug bars, pin connected girder frames, expanded metal, and wire fabric. The steel furniture includes desks, counters, file cabinets, etc. The fittings include doors, window casings and trim. They are designed so as to possess an attractive appearance as well as fireproof properties.

PUMPS AND CENTRIFUGALS.—D'Olier Engineering Co. Philadelphia, Pa. Bulletins No. 4, Series C, and No. 7, Series D. Paper; 6¾ × 10¼ ins.; pp. 12 & 16; illustrated.

The first mentioned of these two bulletins is a reprint from "The American Sugar Industry and Beet Sugar Gazette," describing the Garden City Project of the U. S. Reclamation Service at Deerfield, Kan. The steam turbine power and pumping plant installation for this project was made by the D'Olier Engineering Co. The second bulletin dilates upon the superior merits of the D'Olier direct electric drive centrifugals, extractors and separators as used in the sugar industry, over the same machines when driven by water or belting.

CABLEWAYS.—Lidgerwood Manufacturing Co., 96 Liberty St., New York. Stiff paper; 9 × 11¾ ins.; pp. 168; illustrated.

There are here brought together many illustrations of Lidgerwood cableways in use in various parts of the world for all sorts of engineering construction. Brief text accompanies the excellent half-tones. The text and illustrations together form a quite extensive handbook descriptive of construction of dumps, dry-docks, canals, filtration plants, tunnels, bridges, all over the world. Coal-handling devices for use on sea and on land, and a great variety of other machinery, are also included.

PUMPS AND CONDENSERS.—Reeves & Skinner Machinery Co., Chemical Building, St. Louis, Mo. Catalog No. 1. Paper; 6 × 9 ins.; pp. 105; illustrated.

This catalog does not represent the output of any one manufacturer, but shows a combination of the products of several designers and makers, suited, according to the ideas of the publishers of the pamphlet, to the varying requirements of their customers. The firm is prepared to make surveys of plants and to furnish plans and estimates, contracting for such apparatus as boiler-feed, centrifugal, deep-well, vacuum and general service pumps, air compressors and receivers, distilling, centrifugal or direct acting jet condensers, etc.

SEWAGE APPARATUS.—Merritt & Co., Philadelphia, Pa. Seven sheets, 6¼ × 10 ins.; illustrated.

This unique series of circulars shows on one side detailed drawings simulating blueprints, and on the other side descriptive matter. Sewage lifts, worked both by water and air, automatic flushing siphons and the various types of automatic sewage dosing apparatus are included. With the exception of the so-called water-power sewage lift, all the apparatus described is operated by air and is given the trade name "Aerlock." A number of the devices are protected by recent patents. Included with the circulars is the occasional publication of Merritt & Co., devoted to progress in sewage disposal. This particular number contains among other things a brief bibliography of sewage disposal for 1907.

ELECTRICAL RESISTANCE UNITS.—The General Electric Co., Schenectady, N. Y. Bulletin 4587. Paper; 8 × 10½ ins.; pp. 4; illustrated.

A new type of resistance unit described in this bulletin has several novel features. These consist of a length of wire of negligible temperature coefficient wound spirally about an insulating tube and are made in sizes of from 0.1 to 5,000 ohms, carrying continuously from 0.17 to 45 amperes. The unit is made in two forms, one having porcelain bushings at the end with wire terminals, and the other having metal bushings connected to the winding and suitable for holding in metal grips, and of a size to fit into standard fuse holder clips.

ICE AND REFRIGERATING MACHINERY.—C. A. MacDonald, 301 Monadnock Block, Chicago. Paper; 6 × 9 ins.; pp. 18; illustrated.

This attractive pamphlet presents the special features and merits of the Hercules machines. They have vertical single-acting compression cylinders, operating on a dry-gas system, and are designed particularly with a view to high cylinder efficiency. The larger machines, of 20 to 250 tons daily capacity, are of the beam type, driven by Corliss engines. The smaller machines, of ½-ton to 36 tons capacity, are driven by belting or by direct-connected steam engines. The ammonia condensers, pipe fittings and pipe coils for the refrigerating plants are described and illustrated. The machines are shown to be in extensive use in all parts of the world, and also upon numerous steamships.

MALLET ARTICULATED LOCOMOTIVES.—Baldwin Locomotive Works, Philadelphia, Pa. Paper; 9 × 6 ins.; pp. 44; illustrated.

This is Bulletin No. 65 of the company's series, and contains a paper on "Mallet Articulated Compound Locomotives," which was read before the Engineers' Club of Philadelphia by Mr. Grafton Greenough. The articulated engine dates back to Horatio Allen's "South Carolina," of 1831. Of more modern date are the Fairlie, Mason, Meyer and Mallet types. These several types are compared, and a number of modern Mallet engines are illustrated and described. Most of these are of great size and weight, for heavy service, but some for Porto Rico weigh only 53 tons. Some of the details are illustrated, and designs are shown for Mallet freight and passenger engines of the 2-8-8-2 and 2-4-4-2 classes respectively. The purpose is to distribute great weight on a number of wheels having a flexible wheel base.

ELECTRIC RAILWAY MOTOR.—General Electric Co., Bulletin 4582. Paper; 8 × 10½ ins.; pp. 14; illustrated.

What is called the "GE.—205" railway motor is described in this bulletin. This motor is similar in design and construction to other standard GE. motors, but is provided with commutating poles located between the main field poles. The motor is of the box frame type arranged for oil and waste lubrication with a three-point suspension gear case. The commutating pole railway motor is especially adapted for use under the most severe conditions. An extensive description of the mechanical and electrical details of the apparatus is given in the bulletin. Under the heading of "rating" several pages are devoted to the proper selection of railway motors for various services, and a table is given showing schedule speeds under different conditions. Characteristic curves of different motors and dimension diagrams are included.

WIRE ROPE.—American Steel & Wire Co., New York and Chicago. Paper; 9 × 11¾ ins.; pp. 12; illustrated.

This is not a catalog or price list, but is a pamphlet containing some interesting short articles on some of the varied uses of wire rope. Mr. W. L. Jackson, Chief Engineer of the First National Bank Building, of Chicago, has a paper on "The Different Kinds of Elevators," accompanied by diagrams of rope arrangements. Two pages deal with the use of wire rope on naval and merchant steamers for steering, hoisting and towing, and for use as smokestack guys, etc. The method of guying the 8-ft. 40-ft. smokestacks of the battleship "Connecticut" is illustrated, and the method of protecting the rope from corrosion is described. Other papers deal with the use of wire rope in quarries, the crushing strains in rope wound upon drums, and the design of the company's new "non-spinning" rope for hoisting.

WATER METERS.—Henry R. Worthington, 114 Liberty St., New York. Paper; 6 × 9 ins.; pp. 4; illustrated.

A turbine meter of the current or velocity type, designed to handle large volumes of water with a minimum loss of head, has been put upon the market. It follows the general lines of the Worthington turbine pump. After passing through a large slide strainer, the water column is divided so as to go to both sides of a double impeller, thus securing a water balance. The meter is further described by the manufacturers as follows:

The impeller is surrounded by a chamber of the volute pattern, providing at all points of the circumference the exact cross-sectional area necessary to handle the amount of water discharged by the impeller, at the same time conserving the speed of the water column. The impeller is of special hard rubber composition, carried on a vertical shaft of Tobin bronze. This shaft turns on a jeweled bearing, a hard rubber bushing set in the end of the shaft forming the point of contact. Should occasion require, this bushing may be easily and cheaply renewed.

The meter is made in standard sizes, from 2 to 12 ins., and special meters are furnished of larger size or for special purposes.

For other Proposal Advertisements see pages 39, 40, 42, 44, 47, of Advertisements and Construction News page 28.

MACADAM ROADS.

Newton, N. J.

Sealed bids or proposals will be received at the Freeholders' rooms in the town of Newton, Sussex County, New Jersey, until 11 o'clock A. M. on Friday, July 31, 1908, and then opened, for the grading and macadamizing a section of public road in the townships of Frankford and Sandyston in said County of Sussex, Beginning at a small bridge near William V. Sutton's residence on the Blue Mountain in Culvers' Gap at the south end of the present macadam road and extending to the line of the Borough of Branchville, a distance of three and one-half miles.

Each bid must be accompanied by a certified check, payable to the order of the Director of the Board of Chosen Freeholders in the sum of one thousand dollars, as a guarantee that if the contract shall be awarded to the bidder, he shall, when required by said Board, execute an agreement, and furnish a satisfactory bond in a sum equal to the estimated cost of the road.

Plans and specifications may be found at the office of A. H. Konkle, County Engineer, Newton, N. J., where information, blank bids, and bonds may be obtained. Specifications and blanks may also be had at L. J. Martin's Law Office, Newton, N. J., and of J. J. Coons, Sussex, N. J.

The Board of Chosen Freeholders reserves the right to reject any and all bids.

LOREN T. COLE,
Director of the Board of Chosen Freeholders of Sussex County, N. J.

Dated July 15, 1908.

ADDITION TO FILTER PLANT.

Danville, Pa.

Plans and specifications, with bids, will be received until twelve o'clock, noon, Thursday, August 13th, for addition to the building and mechanical filter plant of the State Hospital for the Insane, at Danville, Pa., the New York Continental Jewel Filtration plant now in use.

A check of One Thousand Dollars to the order of Alex. Foster, Treasurer, must accompany each bid, which sum shall be forfeited in the event of the successful bidder not entering into a contract with satisfactory bond in the sum of twenty-five p[er cent] of the amount of the contract.

The right is reserved to reject [all] bids, or parts of bids, as may be the best interests of the State.

Address all bids to

WILLIAM FIELD SHAY, Pr[esident]
c/o Dr. H. B. Meredith, Su[perintendent]
Dan[ville], Pa.

Situations Op[en]

WANTED—A first-class maca[roni] foreman. Must be sober and [give] recommendations; none other n[eed] WILKES-BARRE CONSTRUC[TION] 53 Bennett Building, Wilkes-[Barre, Pa.] 3-1t

FOREMAN, trustworthy, wideaw[ake] under 30, good at handling men [and] rienced in city work, preferably [in] concrete, foundations or short[age] knowledge of machinery. CLA[SSIFIED] Broadway, New York.

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